IEEE Canadian Review
La revue canadienne de l'IEEE
Fall 2019/Winter 2020 – No. 82

Moving Ahead to 2020

IEEE Canada 2019 Award Recipients

Triumph of a Dream

IEEE Canada
The Institute of Electrical and Electronic Engineers Inc.

President's Message/Message du Président

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Ph.D., FEIC, SMIEEE

2018–2019 IEEE Canada President and Region 7 Director
La Présidente de l'IEEE Canada et Directrice de la région 7, 2018–2019

As the outgoing IEEE Canada president, I have the honour and privilege of addressing you in this space for the last time to share IEEE and IEEE Canada news and highlights with you.

Celebrating Outstanding Contributions

In April 2018 and May 2019, the Engineering Institute of Canada, IEEE, and IEEE Canada held their annual Awards Gala events to celebrate our illustrious award recipients. Congratulations to all awardees, and thanks to all who submitted nominations. More on the awards can be found in this issue. We also have a new Friend of IEEE Member and Geographical Activities (MGA) awardee: the IEEE Montreal Section. In 2018, Mike Lazaridis, founder of Blackberry and co-chairman and co-chief executive officer of BlackBerry from 1984 to 2012, received Honorary Member of IEEE status. Mike is an Officer of the Order of Canada and holds honorary doctorate from the University of Waterloo.

IEEE Sections Congress 2020

In June 2018, IEEE Canada received great news: the next IEEE Sections Congress, a gathering of IEEE volunteers from all

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En tant que Présidente sortant de l'IEEE Canada, j'ai l'honneur et le privilège de m'adresser à vous dans cet espace pour la dernière fois et pour partager avec vous les nouvelles et les faits saillants de l'IEEE Canada.

La Célébration des contributions exceptionnelles

En avril 2018 et en Mai 2019, l'Institut d'Ingénierie du Canada de l'IEEE et l'IEEE Canada ont tenu leurs galas annuels de remise des prix pour célébrer nos illustres récipiendaires de prix. Félicitations à tous les lauréats, et merci à tous ceux qui ont soumis des candidatures. Vous trouverez plus de prix dans ce numéro. Nous avons également un nouvel ami des membres de l'IEEE et des activités géographiques de lauréat (MGA): la section de l'IEEE Montréal. En 2018, Mike Lazaridis, fondateur de Blackberry et coprésident et co-directeur général de BlackBerry de 1984 à 2012, a reçu le statut de membre honoraire de l'IEEE. Mike est Officier de l'Ordre du Canada et docteur honoraire de l'Université de Waterloo.

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Moving Ahead to 2020

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President's Message/Message du Président

(President's Message cont'd from p. 1)

Sections around the world, will be hosted in Ottawa in August 2020. Congratulations to all the volunteers and friends who worked tirelessly to attract the next IEEE Sections Congress to Canada. This will be the third time that this triennial event comes to our Region (Toronto in 1990 and Quebec City in 2008).

IEEE Canadian Review

In Canada, we are very proud to have our own wonderful magazine, *IEEE Canadian Review* (*ICR*). *ICR* took a pause as the search for a new editor-in-chief (EIC) was initiated and the default delivery method was being explored. It is my great pleasure to announce that Jahangir Khan has accepted the role of EIC. I would also like to express my gratitude to Bruce Van-Lane for serving as the EIC from 2015 to 2018. Bruce took *ICR* to new heights during his tenure, and I wish him all the very best in his new endeavours.

ICR issues have been delivered to your mailing address for many years as a glossy, hard-copy magazine. Less well known, in recent years, the magazine has been available as a PDF on its website as well. Last year, the *ICR* team developed a full web version of *ICR* (canrev.ieee.ca). It is the intention of IEEE Canada to continue to have these three ways to access the magazine available to all. Of course, the question arose: what should the default delivery/access method be, a mailed hard copy, online access, or an emailed PDF?

Keeping in mind the trend of going online and the need for sustainability and cost containment, the IEEE Canada Board decided to transition to electronic access for *ICR*.

Keeping in mind the trend of going online and the need for sustainability and cost containment, the IEEE Canada Board decided to transition to electronic access for *ICR*. Starting with this issue, the default delivery will be through digital methods, and hard copies will be mailed only to those who opt in for it. For all of you who prefer the mailed hard copy of *ICR*, it will remain available, free of charge, as long as you confirm that you prefer this service. Emails and notifications regarding the opt-in mechanism have been sent out. The *ICR* website will also have this information. We appreciate your cooperation and patience on this matter.

Canadian Journal of Electrical and Computing Engineering

Canadian Journal of Electrical and Computing Engineering (*CJECE*) has also seen changes during the past two years: it has added the option of open-access publishing. *CJECE* is now a hybrid magazine. The delivery mode has been changed from default hard copy to default online, although hard copies are still available, especially to some of our offshore library subscribers.

On behalf of IEEE Canada, I would like to express sincere thanks to Shahram Yousefi, EIC (2012–2019), and his editorial and administrative teams for so expertly leading *CJECE*

(Message du Président suite de p. 1)

Congrès des Sections IEEE 2020

En juin 2018, l'IEEE Canada a reçu d'excellentes nouvelles : le prochain Congrès des sections de l'IEEE, un rassemblement de bénévoles de l'IEEE de toutes les sections du monde, aura lieu à Ottawa en août 2020. Félicitations à tous les bénévoles et amis qui ont travaillé sans relâche pour attirer le prochain Congrès des sections de l'IEEE au Canada. Ce sera la troisième fois que cet événement triennal se produira dans notre région (Toronto en 1990 et Québec en 2008).

La Revue Canadien de l'IEEE

Au Canada, nous sommes très fiers d'avoir notre merveilleux magazine, IEEE Canadian Review (ICR). L'IC a pris une pause alors que la recherche d'un nouveau rédacteur en chef (EIC) a été lancée et que la méthode de livraison par défaut était à l'étude. C'est avec grand plaisir que j'ai l'honneur d'annoncer que Jahangir Khan a accepté le rôle d'EIC. Je tiens également à exprimer ma gratitude à Bruce Van-Lane pour avoir été l'EIC de 2015 à 2018. Bruce a porté l'IC vers de nouveaux sommets au cours de son mandat, et je lui souhaite tout le meilleur dans ses nouvelles entreprises.

En gardant à l'esprit la tendance à l'accès en ligne et la nécessité de durabilité et de maîtrise des coûts, IEEE Canada a décidé de passer à l'accès électronique pour l'IC.

Les numéros d'IC ont été livrés à votre adresse postale depuis de nombreuses années en tant que magazine sur papier glacé et sur papier. Moins connu, ces dernières années, le magazine a été disponible en FORMAT sur son site web ainsi. L'année dernière, l'équipe de l'IC a développé une version web complète de l'IC (canrev.ieee.ca). L'IEEE Canada a l'intention de continuer d'avoir ces trois façons d'accéder au magazine à la disposition de tous. Bien sûr, la question se pose : quelle devrait être la méthode de livraison/accès par défaut, une copie papier par la poste, un accès en ligne ou un PDF envoyé par courriel?

En gardant à l'esprit la tendance à l'accès en ligne et la nécessité de durabilité et de maîtrise des coûts, IEEE Canada a décidé de passer à l'accès électronique pour l'IC. À partir de ce problème, la livraison par défaut sera par des méthodes numériques, et les copies papier seront envoyées uniquement à ceux qui optent pour elle. Pour tous ceux d'entre vous qui préfèrent la copie papier postée de l'IC, il restera disponible, gratuitement, tant que vous confirmez que vous préférez ce service. Des courriels et des notifications concernant le mécanisme d'adhésion ont été envoyés. Le site Web de l'IC aura également cette information. Nous apprécions votre coopération et votre patience à cet égard.

Le Journal Canadien de Génie Électrique et Informatique

Le Journal canadien de génie électrique et informatique (JCGÉI) a également connu des changements au cours des deux dernières années: Il a ajouté l'option de publication en libre accès. JCGÉI est maintenant un magazine hybride. Le mode

through these transitions to new heights. I also welcome the new editors of *CJECE*, Mohamed Shehata, EIC (Vancouver Section/Okanagan Subsection), and Yang Shi, co-EIC (from Vancouver Section).

Compliance With the General Data Protection Regulation

The General Data Protection Regulation (GDPR) went into effect in late May 2018. A few of the very visible measures that the IEEE has taken are

- identification of the use of cookies on all IEEE-related websites via a banner across the top/bottom of the sites
- requesting consent to continue contacting all of us on various mailing lists
- implementation of training modules, especially for IEEE volunteers.

Three New Events in Canada

We have three new events in Canada. Congratulations to Elena Uchiteleva, Sean Garrity, Selyn Chen, and their teams for making this happen. The events are

The IEEE app, available to Members and nonmembers alike, was upgraded substantially and re-released on 17 November 2019.

- the IEEE Pacific Northwest Young Professional Summit (August 2018 in Vancouver and July 2019 in Seattle, Washington)
- the IEEE Women in Engineering (WIE) International Leadership Summit (September 2018 in Mississauga, October 2019 in Halifax, and planned for fall 2020 in Vancouver)
- the first-ever IEEE WIE Tech Powered by Women (TechW) Workshop (September 2018 in Vancouver).

IEEE Canada Conference News

In 2019, IEEE Canada acquired a new conference: the Symposium on Antenna Technology and Applied Electromagnetics (ANTEM), as originally developed by Dr. Lot Shafai. The first ANTEM conference under IEEE Canada leadership will be held in 2021.

The IEEE Canada International Humanitarian Technology Conference (IHTC) is now being shared between Region 8 (Europe, Africa, and parts of Asia), Region 9 (Latin America), and Region 7 (Canada). IHTC 2020 will take place in Bogotá, Colombia, and IHTC 2021 will be hosted by Region 8.

IEEE App Rebuilt

The IEEE app, available to Members and nonmembers alike, was upgraded substantially and re-released on 17 November 2019. It now features trending IEEE news and gives access to magazines, available benefits, other app users, rosters,

de livraison est passé de la copie papier par défaut à la copie par défaut en ligne, bien que des copies papier soient toujours disponibles, en particulier pour certains de nos abonnés de bibliothèque offshore. Au nom de l'IEEE Canada, je tiens à exprimer mes sincères remerciements à Shahram Yousefi, EIC (2012-2019), et à ses équipes éditoriales et administratives pour avoir si habilement dirigé le JCGÉI à travers ces transitions vers de nouveaux sommets. Je souhaite également la bienvenue aux nouveaux rédacteurs en chef du JCGÉI, Mohamed Shehata, EIC (section Vancouver / section Okanagan) et Yang Shi, co-EIC (de la section Vancouver).

La conformité au règlement général sur la protection des données

Le règlement général sur la protection des données (RGPD) est entré en vigueur fin mai 2018. Quelques-unes des mesures très visibles que l'IEEE a prises sont

- L'identification de l'utilisation des cookies sur tous les sites Web liés à l'IEEE via une bannière en haut / en bas des sites
- Demander le consentement pour continuer à nous contacter tous sur différentes listes de diffusion
- La mise en place de modules de formation, notamment pour les volontaires de l'IEEE. Trois nouveaux événements au Canada.

Nous avons trois nouveaux événements au Canada.

Félicitations à Elena Uchiteleva, Sean Garrity, Selyn Chen et leurs équipes pour avoir rendu cela possible. Les événements sont:

- Le Sommet des jeunes professionnels de l'IEEE du Pacific Nord Ouest (août 2018 à Vancouver et juillet 2019 à Seattle, Washington)
- Le Sommet international sur le leadership des Femme en Ingenierie de l'IEEE (FII) (septembre 2018 à Mississauga, octobre 2019 à Halifax et prévu pour l'automne 2020 à Vancouver)
- Le tout premier atelier des FII de l'IEEE Tech Powered by Women (TechW) (septembre 2018 à Vancouver).

Les Nouvelles de la conférence de l'IEEE Canada

En 2019, l'IEEE Canada a acquis une nouvelle conférence: le Symposium sur la technologie des antennes et l'électromagnétisme appliqué (ANTEM). La première conférence ANTEM sous la direction de l'IEEE Canada se tiendra en 2021.

La Conférence internationale sur les technologies humanitaires (IHTC) de l'IEEE Canada est maintenant partagée entre la Région 8 (Europe, Afrique et certaines parties de l'Asie), la Région 9 (Amérique latine) et la Région 7 (Canada). L'IHTC 2020 aura lieu à Bogotá, en Colombie, et l'IHTC 2021 sera hébergé par la Région 8.

l'Application IEEE Reconstruite

L' Appli de l'IEEE, disponible pour les membres et les nonmembres, a été substantiellement mise à niveau et republiée le 17 novembre 2019. Elle propose désormais des nouvelles tendances de l'IEEE et donne accès aux magazines, aux avantages disponibles, aux autres utilisateurs de l'Application, aux listes et aux rencontres, selon sur votre statut de membre. Testez l'application IEEE et envoyez vos commentaires - votre

and meet-ups—depending on your membership status. Test drive the IEEE app and send your feedback—your experience is important to the IEEE.

New Liaison Position at IEEE Canada

IEEE Canada established a new volunteer position in 2018 and has appointed Glenn Parsons as the liaison between the Region and IEEE Standards Association (SA). His responsibilities include fostering industrial connections and the promotion of standards education in universities and colleges.

Dedication Ceremony

In September 2019, I had the honour of attending the dedication ceremony to commemorate the "First Search and Rescue Using Satellite Location Technology, 1982," successfully held at the Canada Space and Aviation Museum in Ottawa on 9 September 2019. Bronze plaques, in both English and French, were unveiled by the chief guest, Dr. Robert Thirsk, and IEEE President Jose' M.F. Moura. The event was attended by high-profile representatives from the National Search and Rescue Secretariat, Canadian Armed Forces, National Research Council, and Department of National Defense.

Highlighting Partnerships With IEEE Student Branches

The Winnipeg Section Student Branch collaborated with the University of Manitoba Space Applications and Technology Society on the development of nanosatellites. A fourth-generation nanosatellite designed and

Congratulations to all of the new unit formations in IEEE Canada in 2018 and 2019!
Félicitations à toutes les nouvelles unités de formations de l'IEEE Canada de 2018 et 2019!

- **Canadian Atlantic Section**: Dalhousie University IEEE Student Branch Joint Chapter of the IEEE Industry Applications Society and the IEEE Power & Energy Society (IA34/PE31)
  ***La section de l'Atlantique canadien**: section mixte de la branche étudiante de l'IEEE de l'Université Dalhousie de la société de l'industrie d'Applications de l'IEEE et la société de l'énergie électrique de l'IEEE*
- **Hamilton Section**: Mohawk College of Applied Arts and Technology IEEE WIE Student Branch Affinity Group
  ***La section de Hamilton**: Collège d'affinité du Mohawk College of Applied Arts and Technology IEEE WIE*
- **Montreal Section**: IEEE Life Member Affinity Group
  ***La section de Montréal**: Groupe d'affinité des membres de l'IEEE Vie*
- **Kingston Section**: Queens University IEEE Student Branch WIE Affinity Group
  ***La section de Kingston**: Le groupe d'affinité des FEI de la branche Étudiante de l'IEEE de l'université Queen's*
- **New Brunswick Section**: University of New Brunswick IEEE Power Electronics Society Student Branch Chapter (PEL35)
  ***La section du Nouveau-Brunswick**: La société de l'Électronique de Puissance de la branche étudiante de l'université du Nouveau-Brunswick*
- **North Saskatchewan Section**: Formation of an IEEE Circuits and Systems, Communications, and Signal Processing (CAS04/COM19/SP01) Joint Societies Chapter
  ***La section du Nord de la Saskatchewan**: Formation d'une branche sur les sociétés mixtes Circuits et systèmes de l'IEEE, communications et Traitement du signal (CAS04 / COM19/SP01)*
- **Northern Canada Section**: IEEE WIE Affinity Group
  ***La section Nord du Canada**: Groupe d'affinité de FEI de l'IEEE*
- **Northern Canada Section**: IEEE Power Electronics Society Chapter (PEL35)
  ***La section du Nord du Canada**: la Branche de La société de la puissance Électronique de l'IEEE*
- **Quebec Section**: Laval University IEEE Photonics Society Student Branch Chapter (PHO36)
  ***La section du Québec**: La société photoniques de l'IEEE de la branche des étudiants de l'Université Laval*
- **Southern Alberta Section**: University of Calgary IEEE Engineering in Medicine and Biology Society Student Branch Chapter (EMB18)
  ***La section du sud de l'Alberta**: la branche étudiante de l'ingénierie IEEE de l'Université de Calgary en médecine et en biologie*

(Continued)

expérience est importante pour l'IEEE.

Le nouveau poste de liaison à l'IEEE Canada

l'IEEE Canada a créé un nouveau poste de bénévole en 2018 et a nommé Glenn Parsons comme agent de liaison entre la région et Association des Normes de l'IEEE (ANI). Ses responsabilités comprennent la promotion des relations industrielles et la promotion de l'enseignement des normes dans les universités et les collèges.

La cérémonie de dédicace

En septembre 2019, j'ai eu l'honneur d'assister à la cérémonie de dédicace pour commémorer la «Première recherche et sauvetage utilisant la technologie de localisation par satellite, 1982», tenue avec succès au Musée de l'aviation et de l'espace du Canada à Ottawa le 9 septembre 2019. Des plaques de bronze, dans les deux Langues l'anglais et le français ont été dévoilés par l'invité en chef, le Dr Robert Thirsk, et le président de l'IEEE, José MF Moura. Des représentants de haut niveau du Secrétariat national de recherche et de sauvetage, des Forces armées canadiennes, du Conseil national de recherches et du ministère de la Défense nationale ont assisté à l'événement.

Mettre en évidence les partenariats avec les branches étudiantes de l'IEEE

La branche étudiante de la section de Winnipeg a collaboré avec la Société des applications spatiales et de la technologie de l'Université du Manitoba sur le développement des nanosatellites. Un nanosatellite de

implemented by this team won the Canadian Satellite Design Challenge. Many students from different departments contributed, together with their many professional advisors. Witold Kinsner, IEEE Canada past president 2018–2019, has been the university advisor to the project from its inception. Congratulations to all of the team members and supporters.

On another note: under the leadership of Witold Kinsner, our wonderful concept of the McNaughton Student Center is being promoted to, discussed, and considered for implementation by other IEEE Regions.

Changes in Leadership for IEEE Canada

The start of January 2020 marks the biennial change in the leadership of IEEE Canada. Thanks go to Witold Kinsner for his excellent leadership and many significant contributions to IEEE Canada as president-elect, president, and past president during the past six years. He dedicated much of his effort to recruiting new volunteers to the Region and improving the recruitment process. His passions are driving changes for the benefit of humanity, technical education, and access to education for disadvantaged groups, such as young people in Canada's northern communities. During the last few years, he revitalized Educational Activities at the Regional level and organized a number of very successful science camps for indigenous young people.

Congratulations to Robert (Rob) Anderson, IEEE Southern Alberts Section, on winning the 2019 Region 7 director election. Thanks to both Rama Vinnakota, IEEE Vancouver Section, and Rob for stepping up to the plate and volunteering to serve for the six-year commitment as Region director, director-elect,

(Continued)

- **Southern Alberta Section**: University of Calgary IEEE Student Branch Chapter of the IEEE Photonics Society (PHO36)
  ***La section du sud de l'Alberta**: la société de photoniques de l'IEEE la branche étudiante de l'IEEE de l'Université de Calgary*
- **Southern Alberta Section**: University of Calgary Student Branch Joint Societies Chapter of the IEEE Robotics and Automation and Computer Societies (RA24/C16)
  ***La section du sud de l'Alberta**: section des sociétés mixtes de la branche étudiante de l'Université de Calgary de l'IEEE Robotiques, Automation and Informatiques (RA24/C16)*
- **Toronto Section**: Ryerson University IEEE Computer Society Student Branch Chapter (C16)
  ***La section de Toronto**: La société Informatique de l'IEEE de La branche étudiante de l'IEEE de l'Université Ryerson*
- **Toronto Section**: Ryerson University IEEE Engineering in Medicine and Biology Society Student Branch Chapter (EMB18)
  ***La section de Toronto**: La branche Étudiante de la société de l'ingénierie en Médecine et Biologie de l'IEEE de l'université Ryerson*
- **Toronto Section**: Ryerson University IEEE Industry Applications Society Student Branch Chapter (IA34)
  ***La section de Toronto**: La société de l'industrie d'Applications de la branche Étudiante de l'université Ryerson*
- **Toronto Section**: Ryerson University IEEE Power & Energy Society Student Branch Chapter (PE31)
  ***La section de Toronto**: La société de l'Énergie Électrique de l'IEEE de la branche Étudiante de l'université Ryerson*
- **Toronto Section**: Separation of the IEEE Toronto Section Joint Chapter, IA34/PEL35/CE08 into two chapters [new Industry Applications Society Chapter (IA34) and new Joint Power Electronics Society and Consumer Electronics Chapter (PEL35/CE08)]
  ***La section de Toronto**: La séparation du chapitre conjoint de la section de Toronto de l'IEEE, IA34/PEL 35 / CE08 en deux chapitres (nouveau chapitre de la société d'industrie d'Applications et La nouvelle société commune d'électronique de puissance et électronique de consommation)*
- **Vancouver Section**: Simon Fraser University IEEE Ultrasonics, Ferroelectronics, and Frequency Control Student Branch Chapter (UFFC20)
  ***La section de Vancouver**: La société d'ultrasons, ferroélectrique et contrôle de fréquence de l'IEEE de La branche étudiante de l'IEEE de l'Université Simon Fraser*
- **Victoria Section**: IEEE WIE Affinity Group (formed in late 2017)
  ***La section de Victoria**: Groupe d'affinité des FEI (formé fin 2017)*
- **Winnipeg Section**: Formation of an IEEE HKN Chapter
  ***La Section de Winnipeg**: La formation d'une section IEEE HKN*
- **Winnipeg Section**: University of Manitoba IEEE Industry Applications Society Student Branch Chapter (IA34)
  ***La section de Winnipeg**: La société de l'industrie d'Applications de la branche Étudiante de l'université du Manitoba.*

quatrième génération conçu et mis en œuvre par cette équipe a remporté le défi de conception de satellites canadiens. De nombreux étudiants de différents départements ont contribué, ainsi que leurs nombreux conseillers professionnels. Witold Kinsner, ancien président de l'IEEE Canada 2018-2019, est le conseiller universitaire du projet depuis sa création. Félicitations à tous les membres et supporters de l'équipe. Sur une autre note: sous la direction de Witold Kinsner, notre merveilleux concept du Centre d'étudiant McNaughton est promu, discuté et envisagé pour sa mise en œuvre par d'autres régions de l'IEEE.

Changements de leadership de l'IEEE Canada

En début de janvier 2020 marque le changement biennal de la direction de l'IEEE Canada. Merci à Witold Kinsner pour son excellent leadership et ses nombreuses contributions importantes à l'IEEE Canada en tant que président élu, président et ancien président au cours des six dernières années. Il a consacré une grande partie de ses efforts au recrutement de nouveaux bénévoles dans la région et à l'amélioration du processus de recrutement. Ses passions entraînent des changements au profit de l'humanité, de l'enseignement technique et de l'accès à l'éducation pour les groupes défavorisés, tels que les jeunes des communautés nordiques du Canada. Au cours des dernières années, il a revitalisé les activités éducatives au niveau régional et organisé un certain nombre de camps scientifiques très réussis pour les jeunes autochtones.

and past director. Congratulations to you both on a well-run election campaign. Rob will serve as the IEEE Canada president-elect for 2020–2021.

Welcome to Jason Gu as the incoming IEEE Canada president, and best wishes for an excellent two years as the IEEE Canada president for 2020–2021.

IEEE Canada Turns 25 on 1 January 2020

As many of you know well, IEEE has a long and brilliant history in Canada going back to founding Sections in the early 1900s. However, the name "IEEE Canada" for IEEE Region 7 and the title of "IEEE Canada president" for the IEEE Region 7 director/delegate only came to be 25 years ago.

The oldest IEEE Sections in Canada are the IEEE Toronto and Vancouver Sections formed in 1903 and 1911, respectively. Three members from IEEE Canada were elected to the office of president of the IEEE: Robert H. Tanner (1972), Wallace S. Read (1996), and Raymond D. Findlay (2002). Raymond Findlay was also the first Region director to become IEEE Canada president in 1995.

There were many mergers and name changes along the way—please have a look at a brief history on the IEEE Canada website: https://www.ieee.ca/en/about/history/. The last of these mergers—the merger of the Canadian Society of Electrical and Computer Engineering (CSECE) with IEEE Region 7—was approved by the IEEE Board of Directors on 20–21 November 1994 as follows: Approved revisions to the IEEE Bylaw 401.5 Regions, effective 1 January 1995, designating IEEE Region 7 as IEEE Canada; naming the director of IEEE Region 7 as president, IEEE Canada; and delegating to IEEE Canada the right to join the Engineering Institute of Canada (EIC) ….

Happy 25th Anniversary IEEE Canada!

IEEE Canada is a formidable organization with innumerable committed and talented members who volunteer in many different roles. We all work together to contribute to the mission, goals, and priorities of the IEEE and its organizational units, such as the MGA, Technical Activities Publication Services and Products, Educational Activities, Conferences, and Standards. Please get in touch with your ideas and suggestions maike.luiken@ieee.org.

In closing, I would like to thank you, the IEEE Members in this Region, for investing your confidence and trust in me to lead IEEE Canada for the past two years. Thanks to a fantastic team of volunteers–team IEEE Canada—this has been a most fruitful and rewarding experience. ■

Maike Luiken, Ph.D., FEIC, SMIEEE
2018–2019 IEEE Canada President
2018–2019 IEEE Region 7 Director

Do you have a story that is
- cool, Canadian, and electrifying (literally and figuratively)?
- loaded with colorful graphics and photos?
- not so heavy on equations and technical jargon?
- presentable in 1,000–2,000 words?

We would like to publish your IEEE Canada story. Please contact the *ICR* team at icr@ieee.ca.

Félicitations à Robert (Rob) Anderson, de la section de l'IEEE du Sud de l'Alberta, pour avoir remporté l'élection des administrateurs de la région 7 en 2019. Merci à la fois à Rama Vinnakota, à la section IEEE de Vancouver et à Rob pour être intervenus et se porter volontaires à servir pour l'engagement de six ans en tant que directeur régional, directeur élu et ancien directeur. Félicitations à vous deux pour une campagne électorale bien menée. Rob sera le président élu de l'IEEE Canada pour 2020–2021.

Bienvenue à Jason Gu en tant que nouveau président de l'IEEE Canada et meilleurs vœux pour deux excellentes années en tant que président de l'IEEE Canada pour 2020–2021.

L'IEEE Canada fête ses 25 ans le 1er janvier 2020

Comme beaucoup d'entre vous le savent bien, l'IEEE a une longue et brillante histoire au Canada qui remonte à la création des sections au début des années 1900. Cependant, le nom «IEEE Canada» pour la région 7 de l'IEEE et le titre de «président de l'IEEE Canada» pour le directeur / délégué de la région 7 de l'IEEE ne sont apparus qu'il y a 25 ans.

Les sections IEEE les plus anciennes au Canada sont les sections IEEE Toronto et Vancouver formées en 1903 et 1911, respectivement.

Trois membres de l'IEEE Canada ont été élus au poste de président de l'IEEE: Robert H. Tanner (1972), Wallace S. Read (1996) et Raymond D. Findlay (2002). Raymond Findlay a également été le premier directeur régional à devenir président de l'IEEE Canada en 1995.

Il y a eu de nombreux fusions et changements de nom en cours de route - veuillez consulter un bref historique sur le site Web de l'IEEE Canada: https://www.ieee.ca/en/about/history/.

La dernière de ces fusions - la fusion de la Société canadienne de génie électrique et informatique (SCGEI) avec la région 7 de l'IEEE - a été approuvée par le conseil d'administration de l'IEEE les 20 et 21 novembre 1994 comme suit: «Révisions approuvées du règlement 401.5 de l'IEEE Régions, à compter du 1er janvier 1995, désignant la région 7 de l'IEEE comme l'IEEE Canada; nommer le directeur de la région 7 de l'IEEE entant que président de l'IEEE Canada; et déléguer à l'IEEE Canada le droit d'adhérer à l'Institut d'ingénierie du Canada (EIC)… »

Joyeux 25e anniversaire de l'IEEE Canada!

l'IEEE Canada est une organisation formidable avec plusieurs membres dévoués et talentueux qui font du bénévolat dans de nombreux rôles différents. Nous travaillons tous ensemble pour contribuer à la mission, aux objectifs et aux priorités de l'IEEE et de ses unités organisationnelles, telles que MGA, Services et produits de publication des activités techniques, Activités éducatives et SA. Veuillez entrer en contact avec vos idées et suggestions.

Pour terminer, je voudrais vous remercier les membres de l'IEEE dans cette région, d'avoir investi votre confiance et de m'avoir fait confiance pour diriger l'EEE Canada au cours des deux dernières années. Grâce à une fantastique équipe de bénévoles, l'équipe IEEE Canada, cette expérience a été des plus fructueuses et enrichissantes. ■

Maike Luiken, Ph.D., FEIC, SMIEEE
Présidente de l'IEEE Canada 2018–2019
Directrice de la région 7 de l'IEEE 2018–2019

A Few Words From the Editor-in-Chief / Quelques mots du rédacteur en chef

Jahangir Khan
mjakhan@ieee.org

I wish to start my first note as the editor-in-chief of *IEEE Canadian Review* (*ICR*) by stating how incredibly honoured I am to be an ambassador of the Canadian IEEE community. I am thankful to Maike Luiken, Witold Kinsner, and Wahab Almuhtadi for their encouragement and support during the onboarding process. My special gratitude is reserved for the past editor-in-chief, Bruce Van-Lane, whose work set a high standard for *ICR* that will always be remembered.

After decades of seamless publication, *ICR* went on hiatus for more than a year. This provided the opportunity to do much-needed soul-searching regarding publication methods, communication channels, IT platforms, and delivery options.

As you are well aware, print publications are going through a paradigm shift globally. The needs to leverage advanced digital platforms, stay current with pools of young professionals, and ensure financial viability are at the heart of this discussion. *ICR* is no different. To this end, IEEE Canada made a timely and strategic decision

(Continued on p. 8)

Je souhaite commencer ma première note en tant que rédacteur en chef de la Revue Canadienne de l'IEEE (RCI) en indiquant à quel point je suis incroyablement honoré d'être ambassadeur de la communauté canadienne de l'IEEE. Je suis reconnaissant à Maike Luiken, Witold Kinsner et Wahab Al Muhtadi pour leurs encouragements et leur soutien au cours du processus d'intégration. Ma gratitude particulière est réservée à l'ancien rédacteur en chef, Bruce Van-Lane. On se souviendra toujours des travaux de Bruce sur l'établissement d'une norme aussi élevée pour le RCI.

Après des décennies de publication homogène, l'ICR s'est interrompu pendant plus d'un an. Cela a donné l'occasion de faire une recherche fondamentale sur les méthodes de publication, les canaux de communication, les plates-formes informatiques et les options de diffusion actuels.

Comme vous le savez bien, les publications imprimées traversent un changement de paradigme au niveau mondial. La

(Suite p. 8)

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A Few Words From the Editor-in-Chief / Quelques mots du rédacteur en chef

(A Few Words From the Editor-in-Chief cont'd from p. 7)

to transition *ICR* into a primarily digital publication while making print copies available for those who still wish to receive them.

Another important step taken by the *ICR* team is to work with IEEE Publication Services for a number of editorial, graphic design, and production tasks. This will bring the magazine into the mainstreamed IEEE publication mechanism, ensure sustainable production, and provide online visibility.

IEEE Canada made a timely and strategic decision to transition *ICR* into a primarily digital publication while making print copies available for those who still wish to receive them.

As a comeback issue, this edition of *ICR* contains several contributions that were meant for earlier publication. There are articles recognizing the 2019 IEEE Canada awardees, reflecting on the lives of several highly decorated volunteers whom we lost in 2018–2019, and presenting a few key developments on the technical front.

Although my immediate focus has been on reviving *ICR* and reengaging contributing authors, editors, and support volunteers, I do have an ambitious goal. Over the next few months, I plan to initiate discussions about the long-term strategy of *ICR*, which includes the following steps:

- maintain and attract contributions and editors
- develop a sustainable publication strategy
- publish thematic issues with an eye toward the future
- set up a review panel for technical articles
- rebrand and redesign the magazine where needed
- modernize the *ICR* website using current web platforms
- collect readers' input directly through the web or social media
- revitalize revenue generation and ad collection.

Finally, I would like to thank all readers for their patience and understanding as *ICR* goes through this challenging yet promising transition. The future already looks great. For comments, questions, or concerns, please write to me at mjakhan@ieee.org or icr@ieee.ca. ■

(Quelques mots du rédacteur en chef suite de p. 7)

nécessité de tirer parti des plateformes numériques avancées, de rester en contact avec des groupes de jeunes professionnels et de garantir la viabilité financière est au cœur de cette discussion. la RCI n'est pas différente. À cette fin, l'IEEE Canada a pris une décision rapide et stratégique de transformer la RCI en une publication principalement numérique, tout en permettant des copies imprimées pour ceux qui souhaitent toujours les recevoir.

Une autre étape importante franchie par l'équipe RCI consiste à travailler avec le service de publication de l'IEEE pour un certain nombre de tâches de rédaction, de conception graphique et de production. Cela permettra au magazine de devenir un mécanisme de publication courant de l'IEEE, d'assurer une production durable et de fournir une visibilité IEEExplore.

Cette édition du RCI faisant l'objet d'un retour, elle contient plusieurs contributions destinées à une publication antérieure. Ce numéro reconnaît les lauréats de l'IEEE Canada 2019, réfléchit sur la vie de plusieurs bénévoles hautement décorés que nous avons perdus en 2018–2019 et vise à rattraper quelques développements clés sur le plan technique.

Bien que mon objectif immédiat ait été de relancer la RCI, de réengager les auteurs, les rédacteurs et les volontaires, tout en contribuant au soutien, mon objectif est ambitieux. Au cours des prochains mois, je compte engager des discussions sur la stratégie à long terme de la RCI.

La stratégie de publication à long terme de la RCI:

- maintenir et attirer des contributions et des rédacteurs
- développer une stratégie de publication durable
- publier des numéros thématiques avec un regard sur l'avenir·
- mettre en place un panel de révision pour les articles techniques·
- refaire et conceptionner de nouveau le magazine si nécessaire
- moderniser le site Web de la RCI à l'aide des plateformes Web actuelles
- recueillir les commentaires des lecteurs directement sur le Web ou les médias sociaux
- revitaliser la génération de revenus et la collecte d'annonces

Enfin, je voudrais remercier tous les lecteurs pour leur patience et leur compréhension alors que la RCI traverse cette transition difficile mais prometteuse. L'avenir s'annonce déjà bien.

Pour des commentaires, des questions ou des préoccupations, écrivez-moi à mjakhan@ieee.org ou à icr@ieee.ca. ■

IMPORTANT UPDATES

IEEE Canadian Review (*ICR*) is now a "default-digital" publication.

What does this mean?

- All IEEE Canada members will receive *ICR* in digital formats, either through the website or through the IEEE app.
- Members who have explicitly requested not to receive electronic communication will not receive the digital copies. Default mail delivery of print copies will be discontinued to those members in the future. Members are encouraged to opt in for print copies or modify their electronic communication preferences to receive digital copies.
- A print copy will be delivered only to those full-grade members who request it. This will be provided free of additional costs (included in the annual membership fee).

To opt in for print copies, view digital copies, and to receive other updates, please visit canrev.ieee.ca.

IEEE Canadian Foundation
La Fondation Canadienne de L'IEEE.

FROM THE PRESIDENT—We want to thank you again and recognize your support to the IEEE Canadian Foundation in 2018. Each gift has an impact on future generations and current practitioners and is managed to meet the highest expectations of donor intentions. Your gifts enhance the learning experience for electrical, electronics, and computer engineering students across Canada with our programs of McNaughton Centres and scholarships.

Students and other recipients also benefit through the cofunding of special projects that develop engineering enthusiasm and skills at all levels. Increasingly, these projects use technology for the benefit of humanity. "Success Stories" on our website, the monthly IEEE Canada newsletter, and in this magazine demonstrate the wide range of technical, professional, and development opportunities that your gifts support.

Our General Fund is crucial to our ability to operate each and every year, and your undirected donations allow us to keep our base strong.

Our endowed funds support a wide range of awards, prizes, and scholarships. Please consider a directed donation to endow an IEEE Canada award or create a new award of your choosing.

Gifts may be designated to any one of the following funds of the IEEE Canadian Foundation:

- **General Fund** – supports IEEE McNaughton Learning Resource Centres across Canada, related scholarships, and special grants
- **Canadian Life Members Fund** – supports activities of interest to Life Members, potential engineers, and engineering students
- **Technology for Humanity Fund** – supports new and innovative projects that seek to apply technology for the benefit of humanity
- **Vancouver Section Scholarship Fund** – supports scholarships awarded by the IEEE Vancouver Section
- **The IEEE Power & Energy Society Canadian Scholarship Plus Fund** – supports scholarships in undergraduate electric power programs in Canada
- **The IEEE Canadian Foundation Nick Cercone Graduate Scholarship in Computer Science Fund** – supports a scholarship in computer science, a field of study of interest to the IEEE
- **Kingston Section Scholarship Fund** – supports scholarships awarded by the IEEE Kingston Section
- **Raymond D. Findlay Annual Undergraduate Scholarship** – supports a national scholarship recognizing leadership and professionalism.

We appreciate your past support and urge you to continue to give and increase your contributions where possible. If you have not yet made a donation, please join your peers—this is your opportunity to stand with others who choose to make a difference. We could do so much more with your financial support. All the different ways to give and donor recognition programs are fully described on our website.

The IEEE Canadian Foundation wants to hear from you—if we can better engage and support our community, please let us know. You can contact me at president@ieeecanadianfoundation.org or president@ieeefondationcanadienne.org.

DE LA PART DE LA PRÉSIDENTE—Nous tenons à vous remercier encore une fois et à reconnaître votre soutien à la Fondation canadienne de l'IEEE en 2018. Chaque don a un impact sur les générations futures et les praticiens actuels et aussi est géré pour répondre aux attentes les plus élevées des intentions des donateurs. Vos dons améliorent l'expérience d'apprentissage des étudiants en électricité, en électronique et en génie informatique à travers le Canada grâce à nos programmes de centres McNaughton et de bourses. Les étudiants et les autres bénéficiaires bénéficient également du cofinancement de projets spéciaux qui développent l'enthousiasme et les compétences en ingénierie à tous les niveaux. De plus en plus, ces projets utilisent la technologie au profit de l'humanité. Les «histoires de réussite» sur notre site Web, le bulletin mensuel de l'IEEE Canada et dans ce magazine illustrent le large éventail d'opportunités techniques, professionnelles et de développement que vos dons soutiennent.

Notre fonds général est crucial pour notre capacité à fonctionner chaque année, et vos dons non dirigés nous permettent de maintenir notre base solide. Nos fonds de dotation soutiennent un large éventail de récompenses, prix et bourses. Veuillez considérer un don dirigé pour doter un prix de l'IEEE Canada ou créer un nouveau prix de votre choix. Les dons peuvent être attribués à l'un des fonds suivants de la Fondation Canadienne de l'IEEE:

- **Le Fonds général** – soutient les centres de ressources d'apprentissage McNaughton de l'IEEE à travers le Canada, les bourses d'études connexes et les subventions spéciales
- **Le Fonds des Membres à vie du Canada** – soutient les activités qui intéressent les membres à vie, les ingénieurs potentiels et les étudiants en génie
- **Fonds Technologie pour l'humanité** – soutient des projets nouveaux et innovants qui cherchent à appliquer la technologie au profit de l'humanité
- **Vancouver Section Scholarship Fund** – soutient les bourses accordées par la section Vancouver de l'IEEE
- **Le Fonds canadien de bourses d'études Plus de l'IEEE Power & Energy Society** – soutient les bourses d'études dans les programmes de premier cycle en électricité au Canada
- **La Fondation canadienne de l'IEEE Nick Cercone Graduate Scholarship in Computer Science Fund** – soutient une bourse en informatique, un domaine d'études intéressant l'IEEE
- **Le Fonds de bourses d'études de la section de Kingston** – soutient les bourses accordées par la section de Kingston de l'IEEE
- **La Bourse annuelle de premier cycle Raymond D. Findlay** – soutient une bourse nationale reconnaissant le leadership et le professionnalisme.

Nous apprécions votre soutien passé et vous exhortons à continuer de donner et d'augmenter vos contributions dans la mesure du possible. Si vous n'avez pas encore fait de don, veuillez vous joindre à vos pairs - c'est l'occasion de vous tenir aux côtés de ceux qui choisissent de faire la différence. Nous pourrions faire bien plus avec votre soutien financier. Toutes les différentes façons de donner et les programmes de reconnaissance des donateurs sont décrits en détail sur notre site Web.

Many IEEE members in Canada contribute to the all-volunteer effort that is the IEEE Canadian Foundation, including the invaluable assistance of Luc Matteau, John Mowbray, and many others in preparing this 2018 Honour Roll of Donors.

Yours sincerely,

David H. Whyte
President,
IEEE Canadian Foundation

La Fondation canadienne de l'IEEE veut vous entendre - si nous pouvons mieux engager et soutenir votre communauté, veuillez nous le faire savoir. Vous pouvez me contacter à president@ieeecanadianfoundation.org ou president@ieeefondation canadienne.org.

De nombreux membres de l'IEEE au Canada contribuent à l'effort de bénévolat de la Fondation canadienne de l'IEEE, y compris l'aide inestimable de Luc Matteau, John Mowbray et de nombreuses autres personnes pour préparer ce tableau d'honneur des donateurs 2018.

Cordialement,

David H. Whyte
Président de la Fondation
Canadienne IEEE

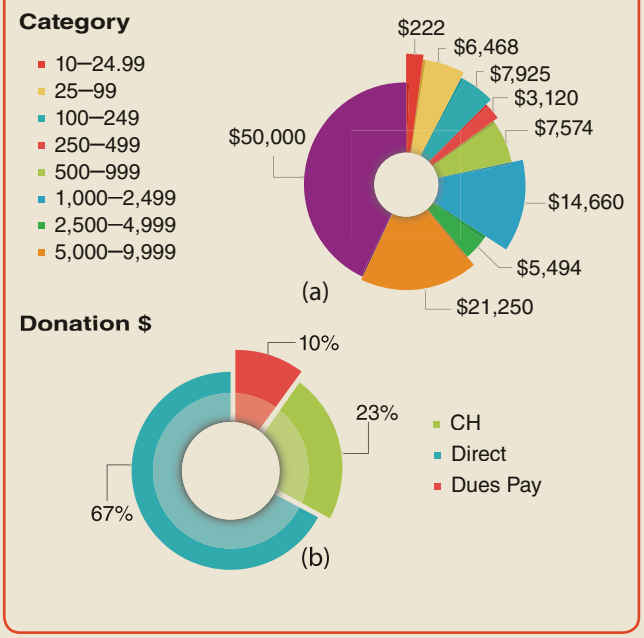
2018 Year in Review

Donations from individuals and organizations in 2018 were $16,231 to General Fund programs and $100,481 to designated programs.

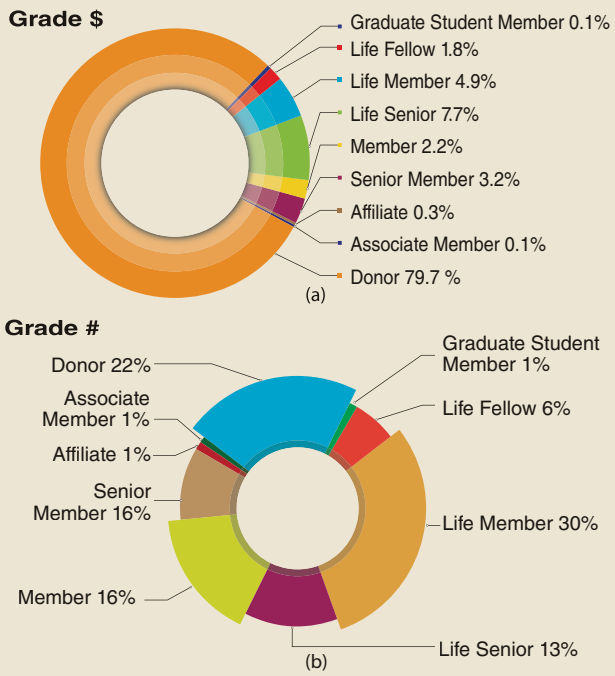
Every gift makes a difference. The honour roll formally recognizes all donors contributing $25 or more. The foundation extends also our thanks to those donors who are not listed.

In 2018, donor gifts helped support

- 5 IEEE McNaughton Learning Resource Centre Grants
- 5 IEEE Canadian Foundation Scholarships
- 22 IEEE Canadian Foundation special grants (including humanitarian grants)
- 1 IEEE Canada Women in Engineering Prize
- 5 IEEE Canada Medals (W.S. Read Outstanding Service Award, Fessenden Award, R.H. Tanner Industry Leadership Award, J.M. Ham Outstanding Engineering Educator Award, and P. Ziogas Electric Power Award)
- 2 IEEE Canadian Foundation Québec Science Fair Prizes
- 1 Findlay Scholarship
- 8 other endowed awards and scholarships.



The 2018 donations by (a) category and (b) payment type.



The 2018 donations by grade, based on (a) amount and (b) number.

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2018 Honour Roll of Donors
Tableau d'honneur des donateurs 2018

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- IEEE Canada members elevated as IEEE Fellows
- IEEE Canada members awarded IEEE Technical Field Awards
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- The Killam Prize
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- Membres de l'IEEE Canada sélectionnés Fellows IEEE
- Membres de l'IEEE Canada récipiendaires d'un prix de secteurs techniques de l'IEEE
- Membres de l'IEEE Canada élus Fellows ICI
- Prix Killam
- Prix de Service de l'IEEE Canada
- Prix de réalisations de l'IEEE Canada

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for important contributions to the field of electric power engineering

C.C. GOTLIEB COMPUTER MEDAL
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W.S. READ OUTSTANDING SERVICE MEDAL
for outstanding and sustained service to IEEE Canada and the Institute

M.B. BROUGHTON CENTRAL CANADA MERIT MEDAL
for meritorious service in central Canada at the local IEEE Section and area level

E.F. GLASS WESTERN CANADA MERIT MEDAL
for meritorious service in western Canada at the local IEEE Section and area level

J.J. ARCHAMBAULT EASTERN CANADA MERIT MEDAL
for meritorious service in eastern Canada at the local IEEE Section and area level

PRIX DE L'IEEE CANADA

MÉDAILLE D'OR A.G.L. MCNAUGHTON
pour contributions exemplaires à la profession d'ingénieur

MÉDAILLE R.A. FESSENDEN
pour contributions importantes dans le domaine du génie des télécommunications

MÉDAILLE P.D. ZIOGAS DE L'ÉLECTRICITÉ
pour contributions importantes dans le domaine du génie électrique

MÉDAILLE C.C. GOTLIEB (INFORMATIQUE)
pour contributions importantes en informatique

PRIX J.M. HAM D'EDUCATEUR EXCEPTIONNEL EN GENIE
pour ses contributions exceptionnelles à l'éducation en genie

MÉDAILLE D'EXCELLENCE EN INGÉNIERIE
pour contributions exceptionnelles augénie électrique et électronique

MÉDAILLE D'EXCELLENCE EN LEADERSHIP INDUSTRIEL R.H. TANNER
pour contributions importantes au niveau du leadership dans l'industrie canadienne où il y a une activité significative dans des domaines d'intérêt de l'IEEE

MÉDAILLE D'OR DE SERVICE W.S. READ
pour service exceptionnel et soutenu à l'IEEE Canada et à l'institut

MÉDAILLE D'EXCELLENCE M.B. BROUGHTON DU CENTRE DU CANADA
pour service méritoire dans le centre du Canada au niveau des sections et zones locales de l'IEEE

MÉDAILLE D'EXCELLENCE E.F. GLASS DE L'OUEST DU CANADA
pour service méritoire dans l'ouest du Canada au niveau des sections et zones locales de l'IEEE

MÉDAILLE D'EXCELLENCE J.J. ARCHAMBAULT DE L'EST DU CANADA
pour service méritoire dans l'est du Canada au niveau des sections et zones locales de l'IEEE

2019 IEEE CANADA A.G.L. MCNAUGHTON GOLD MEDAL
MÉDAILLE D'OR A.G.L. MCNAUGHTON DE L'IEEE CANADA 2019

For contributions to the development of microwave filters and radio frequency micro electro-mechanical systems
Pour contributions au développement des filtres hyperfréquences et des systems microélectromécaniques à radiofréquence

Dr. Raafat Mansour, Waterloo, ON

Dr. Raafat Mansour (FIEEE) is a professor of electrical and computer engineering at the University of Waterloo and holds Tier 1 - Canada Research chair (CRC) in Micro-Nano Integrated RF Systems since 2010. He held an NSERC Industrial Research chair (IRC) for two terms (2001–2005) and (2006–2010). Prior to joining the University of Waterloo in January 2000, Dr. Mansour was with COM DEV Cambridge, Ontario, over the period 1986–1999, where he held various technical and management positions in COM DEV's Corporate R&D Department. Professor Mansour holds 37 U.S. and Canadian patents and more than 380 refereed publications to his credit. He is a coauthor of a 23-chapter Book published by Wiley and has contributed 6 chapters to four other books.

Since joining the University of Waterloo in 2000, Professor Mansour has graduated 35 Ph.D., 31 M.Sc. students and trained 14 postdoctoral fellows. His students hold key positions in academia and industry, including 5 holding faculty positions. Professor Mansour founded the Centre for Integrated RF Engineering (CIRFE) at the University of Waterloo https://uwaterloo.ca/centreintegrated-rf-engineering/. It houses

a clean room and a state-of-the-art RF test and characterization laboratory. Professor Mansour has acted as a catalyst for ideas inspiring the next generation of Waterloo entrepreneurs to bring their work to market. Out of research carried out in his research lab at the University of Waterloo, Professor Mansour and his graduate students jointly cofounded two companies: AdHawk Microsystem (http://www.adhawkmicrosystems.com/) and Integrated Circuit Scanning Probe Instruments (ICSPI-Corp) (https://www.icspicorp.com/).

Professor Mansour is a fellow of the Canadian Academy of Engineering (CAE) and a fellow of the Engineering Institute of Canada (EIC). He was the recipient of the 2014 Professional Engineers Ontario (PEO) Engineering Medal for research and development. ■

Dr. Raafat Mansour (FIEEE) est professeure de génie électrique et informatique à l'Université de Waterloo. Il est titulaire de la Chaire de recherche du Canada de niveau 1 sur les systèmes RF intégrés micro-nano depuis 2010. Il a été titulaire d'une chaire de recherche industrielle du CRSNG pour deux mandats (2001–2005) et (2006–2010). Avant de se joindre à l'Université de Waterloo en janvier 2000, Dr. Mansour a travaillé pour COM DEV à Cambridge, Ontario de 1986 à 1999, où il a occupé divers postes techniques et de direction au sein du département de R&D de la société. Le professeure Mansour détient 37 brevets américains et canadiens et a plus de 380 publications avec comité de lecture à son actif. Il est co-auteur d'un livre de 23 chapitres publié par Wiley et a contribué six chapitres à quatre autres livres.

Depuis son arrivée à l'Université de Waterloo en 2000, le professeure Mansour a dirigé 35 étudiants au doctorat, 31 en maîtrise, et a formé 14 stagiaires postdoctoraux. Ses étudiants occupent des postes clés dans les milieux universitaires et industriels, notamment cinq postes de professeure. Le professeure Mansour a fondé le Centre d'ingénierie RF intégrée (CIRFE) à l'Université de Waterloo (https://uwaterloo.ca/centre-integrated-rf-engineering/). Celui-ci comprend une salle blanche et un laboratoire de test et de caractérisation RF ultramoderne. Le professeure Mansour a agi comme un catalyseur d'idées inspirant la prochaine génération d'entrepreneurs de Waterloo à commercialiser leurs travaux. À l'issue de travaux effectués dans son laboratoire de recherche de l'Université de Waterloo, le professeure Mansour et ses étudiants de

Le professeure Mansour détient 37 brevets américains et canadiens et a plus de 380 publications avec comité de lecture à son actif.

cycles supérieurs ont co-fondé deux sociétés: AdHawk Microsystem (http://www.adhawkmicrosystems.com/) et Integrated Circuit Scanning Probe Instruments (ICSPI) Corp. (https://www.icspicorp.com/).

Le professeure Mansour est membre de l'Académie canadienne du génie (ACG) et de ICI. Il a été récipiendaire en 2014 de l'Engineering Medal for Research and Development de Professional Engineers Ontario (PEO). ■

2019 IEEE CANADA R.A. FESSENDEN MEDAL
MÉDAILLE R.A. FESSENDEN DE L'IEEE CANADA 2019

For highly influential contributions to innovative networking algorithms and protocols for mobile communications
Pour contributions très influentes aux algorithmes de réseautage innovants et aux protocoles de communications mobiles

Dr. Xuemin Shen, Waterloo, ON

Dr. Xuemin (Sherman) Shen (IEEE Fellow, 2009) has been with the Department of Electrical and Computer Engineering, University of Waterloo, since 1993, where he is a university professor. Dr. Shen received the Ph.D. degree in electrical engineering from Rutgers University, New Jersey, USA, in 1990. He is a fellow of the Engineering Institute of Canada, Canadian Academy of Engineering, and Royal Society of Canada, and a registered Professional Engineer in Ontario.

Dr. Shen is internationally recognized for his ground-breaking contributions to the field of wireless communication networks. For twenty-eight years, his research has led to innovative network control and service provisioning algorithms and protocols for technology development, and new analytical techniques and mathematical models for the international research community. In particular, he has made highly influential contributions to fundamental theories and innovative networking protocols for vehicular communications to achieve information security and user privacy in vehicle-to-vehicle and vehicle-to-infrastructure communications for road safety and vehicle traffic management.

Dr. Shen is the editor-in-chief of *IEEE Internet of Things Journal*. He served as the Technical Program Committee chair/cochair for the IEEE Globecom'16, IEEE Infocom'14, IEEE VTC'10 Fall, IEEE Globecom'07, the Symposia chair for the IEEE ICC'10, and the chair of IEEE Communications Society (ComSoc) Technical Committee on Wireless Communications. He has been the elected vice president Publications, IEEE ComSoc, since 2018. He received the James Evans Avant Garde Award in 2018 from IEEE Vehicular Technology Society, the Joseph LoCicero Award in 2015 and Education Award in 2017 from IEEE ComSoc, the Excellent Graduate Supervision Award in 2006 and Outstanding Performance Award five times from the University of Waterloo. ■

Dr. Xuemin (Sherman) Shen (Fellow de l'IEEE, 2009) est professeure d'université au département de génie électrique et informatique de l'Université de Waterloo, Ontario, depuis 1993. Il a obtenu son doctorat en génie électrique en 1990 de l'Université Rutgers, New Jersey, USA. Il est membre de l'Institut Canadien des Ingénieurs, l'Académie Canadienne du Génie et la Société Royale du Canada, et un ingénieur professionnel enregistré de l'Ontario.

Dr. Shen est reconnu internationalement pour ses contributions au domaine des réseaux de communication sans fil. Pour 28 ans, ses recherches ont débouché sur des algorithmes et des protocoles novateurs sur les contrôles du réseau et la fourniture des services, et sur des nouvelles techniques analytiques et des modèles mathématiques, servant ainsi le développement technologique et la communauté internationale des chercheurs. Il a contribué aux théories fondamentales et aux protocoles de réseau innovants pour la communication véhiculaire, afin de garantir la sécurité des informations et la confidentialité des utilisateurs dans les communications véhicule-à-véhicule et véhicule-à-infrastructure, assurant la sécurité routière et la gestion de la circulation automobile.

Dr. Shen est le rédacteur en chef du journal IEEE sur l'Internet des Objets. Il a présidé/coprésidé le comité du programme technique pour l'IEEE Globecom'16, l'IEEE Infocom'14, l'IEEE VTC'10 Automne, et l'IEEE Globecom'07. Il a été le président des symposia pour l'IEEE ICC'10, le président du comité technique sur les communications sans fil de la société de communication (ComSoc) de l'IEEE et le Vice-président Élu des publications de l'IEEE ComSoc depuis 2018. Il a reçu le prix James Evans Avant Garde en 2018 de la société de la communication véhiculaire de l'IEEE, le prix Joseph LoCicero en 2015 et le prix de l'éducation en 2017 de l'IEEE ComSoc, le prix de l'excellente supervision des diplômés en 200 et le prix de performance exceptionnelle (five fois) de l'Université de Waterloo. ■

Dr. Shen est reconnu internationalement pour ses contributions au domaine des réseaux de communication sans fil.

2019 IEEE CANADA P.D. ZIOGAS ELECTRIC POWER MEDAL
MÉDAILLE P.D. ZIOGAS D'ÉNERGIE ÉLECTRIQUE DE L'IEEE CANADA 2019

For contributions to power system protection
Pour contributions à la protection des systèmes électriques

Dr. Bogdan Kasztenny, Markham, ON

Dr. Bogdan Kasztenny (F'08) obtained his M.Sc. and Ph.D. degrees in Electrical Engineering from the Wroclaw University of Science and Technology in Poland in 1989 and 1992, respectively. During the 1990s, Dr. Kasztenny taught power system and signal processing courses at the Wroclaw University of Science and Technology, Southern Illinois University, and Texas A&M University while conducting research for protective relay manufacturers. Between 1999 and 2009, he was with General Electric in Markham, Ontario, designing and supporting many protective relay products. Since 2009, he has been with Schweitzer Engineering Laboratories, Inc. in Markham, where he works on product research and development. In the late 2000s, he served as an adjunct professor at the University of Western Ontario.

Dr. Kasztenny has researched, designed, and supported more than a dozen protection, control, and fault-locating products with their global installed base counted in thousands of installations. In the early 2000s, he was one of the key architects and designers of the first commercially successful modular protective relay (GE Universal Relay). In

the mid 2000s, he was the chief architect for the first commercially viable process bus system for protection and control (GE HardFiber). Most recently, he was a chief researcher and designer of the first truly digital traveling-wave protective relay (SEL-T400L). He has authored over 200 technical papers, coedited 2 chapter books, and holds over 40 patents.

Dr. Kasztenny is an IEEE Fellow class of 2008, a member of IEEE PSRCC, a Senior Fulbright fellow, a Canadian representative of the CIGRE Study Committee B5, and a registered professional engineer in the province of Ontario. In 2004, he received the Thomas A. Edison award for innovation (GE CEO award). He is a distinguished alumni and an honorary consul of his alma mater. ■

Dr. Bogdan Kasztenny (F'08) a obtenu son diplôme de M.Sc. et son doctorat en génie électrique de l'École polytechnique de Wrocław en Pologne en 1989 et 1992 respectivement. Au cours des années 90, Dr. Kasztenny a enseigné les systèmes d'alimentation et de traitement du signal à l'École polytechnique de Wrocław, à la Southern Illinois University, Carbondale, et à la Texas A&M University, College Station, tout en menant des recherches pour des fabricants de relais de protection. Entre 1999 et 2009 il a travaillé pour General Electric (GE) à Markham, Ontario, où il a conçu et supporté plusieurs produits de relais de protection. Depuis 2009 il travaille chez Schweitzer Engineering Laboratories, Inc. à Markham en recherche et développement de produits. Vers la fin des années 2000 il a été professeure auxiliaire à l'Université Western Ontario, London.

Dr. Kasztenny a effectué du travail de recherche, conception et support pour plus d'une douzaine de produits de protection, contrôle et localisation des pannes, avec un parc global comptant des milliers d'installations. Au début des années 2000 il a été l'un des principaux architectes et concepteurs du premier relais de protection modulaire ayant connu un succès commercial (GE Universal Relay). Au milieu des années 2000 il était l'architecte en chef du premier système de bus de processus commercialement rentable pour la protection et le contrôle (GE HardFiber). Plus récemment il a été chercheur en chef et concepteur du premier relais de protection à ondes progressives réellement numérique (SEL-T400L). Il est l'auteur de plus de 200 articles techniques, a co-édité deux chapitres de livres et détient plus de 40 brevets.

Au début des années 2000 il a été l'un des principaux architectes et concepteurs du premier relais de protection modulaire ayant connu un succès commercial.

Dr. Kasztenny est Fellow de l'IEEE depuis 2008, membre de l'IEEE PSRCC, boursier Fulbright senior, représentant canadien du comité d'étude CIGRE B5 et ingénieur professionnel enregistré de la province de l'Ontario. En 2004 il a reçu le prix Thomas A. Edison pour l'innovation (prix du PDG de GE). Il est un ancien élève émérite et consul honoraire de son alma mater. ■

2019 IEEE CANADA C.C. GOTLIEB MEDAL
MÉDAILLE C.C. GOTLIEB DE L'IEEE CANADA 2019

For outstanding contributions to biomedical computing and computer-assisted medical interventions
Pour contributions exceptionnelles à l'informatique biomédicale et aux interventions médicales assistées par ordinateur

Dr. Parvin Mousavi, Toronto, ON

Dr. Parvin Mousavi, Senior Member IEEE, is a professor of Computer Science and Electrical and Computer Engineering at Queen's University, Canada. She has received her Ph.D. from the University of British Columbia, Canada and M.Sc. and DIC from Imperial College, London, UK. She has served as a Senior Research Scientist, at Brigham and Women's Hospital, USA, and as a visiting associate professor at Harvard Medical School, USA, and the University of British Columbia, Canada. Prior to her academic career, she held industrial positions with Molecular Mining Inc. and Biosystemix Inc.

Dr. Mousavi has pioneered a field of inquiry for precise management of complex human disease and personalized computer-assisted diagnosis and therapy. Her innovative research uses machine learning methods on data—from diverse modalities of medical images and omics profiling—to build comprehensive models for disease diagnosis and intervention, while uniquely incorporating patient-specific information. Her approaches enable earlier detection of disease and more effective medical interventions. She is a general cochair of Information Processing in Computer Assisted Interventions (IPCAI), and a satellite cochair for Medical Image Computing and

Computer Assisted Interventions (MICCAI) in 2017 and 2020. She is also a founding member of Women in MICCAI, and has served as associate editor for *PLOS One* and *BMC Bioinformatics*.

Dr. Mousavi is a member of the Royal Society of Canada, College of New Scholars, Artists and Scientists, Canada's first national system of multidisciplinary recognition for the emerging generation of Canadian intellectual leadership. She has received numerous awards and recognitions for research excellence including the Outstanding Young Computer Science Researcher Prize, Canadian Association for Computer Science, the Early Researcher Award, Ontario Ministry of Research and Innovation and best paper awards from IEEE Engineering in Medicine and Biology Conference, SPIE Medical Imaging, MICCAI, IPCAI, and others. ■

Dr. Parvin Mousavi membre sénior IEEE, est professeure d'informatique et de génie électrique et informatique à Queen's University, Canada. Elle a obtenu son Ph. D. de l'University of British Columbia, Canada, et ses M. Sc. et DIC de l'Imperial College, London, UK. Elle a auparavant été chargée de recherche principale à l'hôpital Brigham and Women's, USA, et professeure associée invitée à la Harvard Medical School, USA. Avant sa carrière académique, elle a travaillé chez Molecular Mining Inc. et Biosystemix Inc.

Dr. Mousavi a été une pionnière dans la gestion précise de maladies humaines complexes et dans les diagnostic et thérapie personnalisées assistées par ordinateur. Sa recherche innovatrice utilise l'apprentissage automatique sur des données – provenant de diverses imageries médicales et profils en "-omique" – pour construire des modèles compréhensifs pour les diagnostics et interventions, tout en incorporant des informations spécifiques au patient. Cette approche permet une détection plus précoce de la maladie et l'utilisation de traitements plus efficaces. Elle est co-présidente de l'Information Processing in Computer-Assisted Interventions (IPCAI), de même de co-présidente du Medical Image Computing and Computer-Assisted Interventions (MICCAI) en 2017 et 2020. Elle est aussi une membre fondatrice de Women in MICCAI, et a servi en tant qu'éditrice associée pour PLOS One et BMC Bioinformatics.

Dr. Mousavi est membre de la Société royale du Canada, Collège des nouveaux chercheurs et créateurs en art et en science, le premier système national canadien de reconnaissance

Dr. Mousavi a été une pionnière dans la gestion précise de maladies humaines complexes et dans les diagnostic et thérapie personnalisées assistées par ordinateur.

multidisciplinaire pour la génération émergente de leadership intellectuel canadien. Elle a reçu plusieurs prix et récompenses pour son excellence en recherche, incluant le Prix du jeune chercheur en informatique exceptionnel de l'Association canadienne d'informatique, la Bourse de nouveaux chercheurs du Ministère de la Recherche et de l'Innovation de l'Ontario, de même que des prix pour les meilleurs articles de la IEEE Engineering in Medicine and Biology Conference, SPIE Medical Imaging, MICCAI, IPCAI, et autres. ■

2019 IEEE CANADA J.M. HAM OUTSTANDING ENGINEERING EDUCATOR MEDAL
PRIX J.M. HAM D'ÉDUCATEUR EXCEPTIONNEL EN GENIE DE L'IEEE CANADA 2019

For the dual education program
Pour le programme de double formation

Dr. Tom Murad, Toronto, ON

Dr. Tom Murad, Country Lead of Engineering & Academics at Siemens Canada, a member of Engineering Order of Honor —Professional Engineers Ontario "PEO," is a respected technology leader, thinker, an award-winning educator and distinguished speaker on the topics of engineering, technology and technical talents/skills development and education. Joined Siemens Canada in 2010, he is the founder of the Siemens Canada Engineering and Technology Academy "SCETA," that he established and directed since October 2014. Before his current role, he was the head of the "Expert House" and engineering director for Siemens Canada's Industry sector since 2010. Prior to joining Siemens, Tom was the senior VP and COO of AZZ- Blenkhorn & Sawle.

Dr. Murad has an extensive career in professional engineering and executive management of innovative technical operations including academic and R&D work in electrical power, industrial controls and automation. He is also serving as a member of various advisory boards of directors in the industry and academia.

Dr. Murad holds a bachelor of engineering (electrical and electronics), and a doctorate (Ph.D.) in power electronics and industrial controls from Loughborough University of Technology in the UK, with a leadership program certificate from Schulich Business School, York University in Ontario, Canada.

Dr. Murad is a:

- Fellow of Engineers Canada "F.E.C"
- Senior Member of IEEE
- licensed P.Eng.; (PEO and OSPE) in Ontario; APEGA in Alberta, and NAPEG in the North Western Territories.
- member of PEO Licensing "Engineering Experience Review"- ERC Committee since 2003
- member of Advisory Board - Ryerson University - Engineering Faculty
- member of Ontario Francophone Workforce Development Council (FWDC)
- member of Board of Directors - IEEE Canada & Chair of Executive committee - IEEE Toronto Section (2016–2017)
- member of Board of Directors - Canadian - German Centre for Innovation and Research (2015–2018). ■

Dr. Tom Murad, chef de l'ingénierie et des relations universitaires de Siemens Canada et membre du Order of Honour de l'Ordre des ingénieurs de l'Ontario (PEO), est un chef de file et un penseur éminent en matière de technologie, ainsi qu'un éducateur primé et un conférencier émérite en ce qui a trait à l'ingénierie, à la technologie, au développement des talents/compétences et à la formation dans le domaine technique. Chez Siemens Canada depuis 2010, il est le fondateur de l'Académie d'ingénierie et de technologie de Siemens Canada (AITSC) qu'il dirige depuis octobre 2014. Avant d'occuper ses fonctions actuelles, il était le chef du Centre des experts et directeur de l'ingénierie du secteur Industrie de Siemens Canada depuis 2010. Avant de se joindre à Siemens, Tom était le vice-président principal et le directeur de l'exploitation de AZZ-Blenkhorn & Sawle.

Dr. Murad dispose d'une vaste expérience professionnelle en ingénierie et à la haute direction responsable des activités techniques novatrices, y compris en relations universitaires et en R et D dans les domaines de l'énergie électrique, des commandes industrielles et de l'automatisation. De plus, il siège à divers conseils d'administration dans les milieux industriels et universitaires.

Dr. Murad est titulaire d'un baccalauréat en génie (électrique et électronique) et d'un doctorat en électronique de puissance et commandes industrielles du Loughborough University of Technology, au Royaume-Uni, en plus d'un certificat en Leadership de la Schulich Business School, de l'Université York en Ontario (Canada).

Titres du Dr. Murad:

- Fellow d'Ingénieurs Canada (FEC)
- membre principal de l'IEEE
- ingénieur; (PEO et OSPE) en Ontario; APEGA en Alberta et NAPEG dans les Territoires du Nord-Ouest
- membre du comité de l'Ordre des ingénieurs de l'Ontario ayant octroyé sous licence le logiciel « Engineering Experience Review » depuis 2003
- membre du conseil consultatif de la Faculté de génie de l'Université Ryerson
- membre du conseil du développement de la main-d'oeuvre francophone de l'Ontario
- membre du conseil d'administration de l'IEEE au Canada et président du comité de direction de la section Toronto de l'IEEE (2016–2017)
- membre du conseil d'administration du German-Canadian Centre for Innovation and Research (2015–2018). ■

2019 IEEE CANADA OUTSTANDING ENGINEER MEDAL
MÉDAILLE D'EXCELLENCE EN INGÉNIERIE DE L'IEEE CANADA 2019

For contributions to the development of innovative space technology and to the Canadian engineering community
Pour contributions au développement de technologies spatiales innovantes et à la communauté des ingénieurs du Canada

Dr. Shen-En Qian

Shen-En Qian (SMIEEE) is a senior engineer of spacecraft optical payload at the Canadian Space Agency, where he started as a NSERC post-doctorial visiting fellow since 1994. He completed his Ph.D. in 1990 and continued his study in France as a post-doctor before moving to Canada.

Dr. Qian is a Canadian foremost authority and a world lead in optical payloads and space missions. He invented nine breakthrough space technologies in Canadian government laboratories and holds 35 patents worldwide. These technological solutions have helped overcome the challenges encountered in developing Canadian space missions and lowered their costs. His inventions have been transferred to industry and built into commercial products. As a technical authority of government contracts, he provides leadership to Canadian industry in the development of innovative space technology and helps them enhance their competitiveness and open up new markets in the world. He promotes collaborative R&D with academia and assists universities to train next generation engineers. He is an internationally renowned scholar in space science. As a sole author, he published two books on optical satellites and their signal processing

and applications. These books are the first in the fields and have lasting impact to engineers and scientific community. He coauthored four other books and published over 120 scientific papers. He demonstrated the leadership of a Canadian engineer by leading around 200 space experts in the world in editing a must-have handbook *Optical Payloads for Space Missions*. The Governor General of Canada presented him the Public Service Award of Excellence, in the category scientific contribution, for his exceptional contributions in advancing Canadian space programs in 2016. He received Canadian government invention award and the European Union's Marie Curie Award. He is a fellow of the International Society of Optics and Photonics (SPIE), a fellow of the Canadian Academy of Engineering. ■

Shen-En Qian (SMIEEE) est ingénieur principal au sein du groupe des capteurs optiques de l'Agence spatiale canadienne, où il a débuté à titre de boursier postdoctoral du CRSNG en 1994. Il a obtenu son doctorat (Ph.D.) en 1990 et a fait des études postdoctorales en France avant de s'établir au Canada.

Dr. Qian est une sommité canadienne et un des chef de file à l'échelle mondiale dans le domaine des charges utiles optiques et des missions spatiales. Il est l'inventeur de neuf technologies spatiales innovantes réalisées dans des laboratoires du Gouvernement du Canada et détient 35 brevets de portée mondiale. Ces solutions technologiques ont permis de relever les défis rencontrés lors du développement de missions spatiales canadiennes de même que contribuées à en diminuer les coûts. Ses inventions ont été transférées à l'industrie et intégrées dans des produits commerciaux. À titre d'autorité technique de contrats gouvernementaux, il aide l'industrie canadienne dans le développement de technologies spatiales innovantes et apporte son soutien à leur compétitivité et à l'ouverture de nouveaux marchés mondiaux. Il fait la promotion de la recherche collaborative avec le milieu universitaire et appuie les universités dans leur formation de la prochaine génération d'ingénieurs. Il jouie d'une réputation internationale à titre de chercheur dans le domaine des sciences spatiales. Il a publié, comme seul auteur, deux ouvrages portant sur les satellites optiques, le traitement de signal et les applications. Ces livres sont les premiers dans leur domaines respectifs et ont un impact persistant sur la communauté en ingénierie et en sciences. Il est co-auteur de quatre autres livres et plus de 120 articles scientifiques. Il a démontré son leadership à titre d'ingénieur canadien en menant plus de 200 experts à travers le monde à la rédaction d'un livre de référence essentiel intitulé Optical Payloads for Space Missions. Le Gouverneur général du Canada lui a décerné, en 2016, le Prix d'excellence de la fonction publique dans la catégorie Contribution au corpus scientifique pour sa contribution exceptionnelle à l'avancement du programme spatial canadien. Il est récipiendaire d'un prix du Gouvernement canadien pour ses inventions et du prix Marie Curie de l'Union Européenne. Il est Fellow de l'International Society of Optics and Photonics (SPIE), et Fellow de l'Académie Canadienne du Génie. ■

2019 IEEE CANADA W.S. READ OUTSTANDING SERVICE MEDAL
MÉDAILLE D'EXCELLENCE DE SERVICE W.S. READ DE L'IEEE CANADA 2019

In recognition fo his outstanding and sustained service to the communications and information theory fields
En reconnaissance de ses services exceptionnels et soutenus dans les domaines des communications et théorie de l'information

Dr. Anader Benyamin-Seeyar, Montréal, QC

Dr. Anader Benyamin-Seeyar was a senior telecommunications specialist at Le Groupe SM International, where he was a leading expert for telecommunications and security division involved with telecom pre- and post-sale projects and project management for many national and international programs. He received B.Sc. degree from Iran University of Science and Technology, M.Sc. degree from McGill University and Ph.D. degree from Concordia University (1985) all in electrical engineering. He is an affiliate associate professor at Concordia University, where he taught for many years as part-time teacher and researcher. Since 1985, he has worked for advanced technology companies such as Apollo Microwave, ISR Technologies, PolarSat, ART Advanced Research Technologies, Harris Corporation (Montréal), Vistar Telecommunications, Spar Aerospace/ComStream (or MDA Corporation), and Bell-Northern Research (BNR) in the areas of satellite and terrestrial communications.

He has been with the IEEE Montréal Section as Section secretary and Section chair (2006–2008). He initiated and chaired the IEEE Teachers In Service Program (TISP) Committee of Canada (2009–2013). He is a nomination and awards committee chair of Montréal Section. He is a member

of the IEEE Canadian Foundation Committee (ICF) Grants program. He is the coordinator of the Global IEEE ComSoc Distinguished Lecture Tour (DLT/DSP). Further, he was involved in many national and international conferences, such as Microwave Theory and Technology (MTT) 2012 and ICC 2021. Has was actively contributing to the development of IEEE 802.16 standardization.

He is chairing the communications and information theory Chapter of the Section and was instrumental in helping to win the North America Award and the Global IEEE Communications Society Chapter-of-the-Year Award in 2012. He was awarded with the IEEE MGA Leadership Award for 2008. He won the 2014 IEEE J.J. Archambault Eastern Canada Service Award. He led the IEEE Montréal Section to win IEEE Canada's Large Section Award for 2008. ■

Dr. Anader Benyamin-Seeyar principal en télécommunications au Groupe SM International, où il était expert principal pour la division Télécommunications et Sécurité, impliquée dans les projets Télécom avant et après-vente et la gestion de projets pour de nombreux programmes nationaux et internationaux. Il a reçu un B.Sc. diplôme de l'Université des sciences et technologies d'Iran, M.Sc. diplôme de l'Université McGill et Ph.D. diplômé de l'Université Concordia, tous en génie électrique. Il est professeure associé affilié à l'Université Concordia, où il a enseigné pendant de nombreuses années en tant qu'enseignant et chercheur à temps partiel. Depuis 1985, il a travaillé pour des sociétés de technologie de pointe telles qu'Apollo Microwave, ISR Technologies, PolarSat, ART Technologies de recherche avancées, Harris Corporation, Vistar Telecommunications, Spar Aerospace/ComStream et Bell-Northern Research dans les domaines des communications par satellite et terrestre.

Il a été membre de la section Montréal en tant que secrétaire et président de section (2006–2008). Il a initié et présidé le comité du programme Teachers In Service (TISP) du Canada (2009–2013). Il est président du comité des nominations et des prix de la section. Il est membre du comité de la fondation canadienne de l'IEEE (ICF). Il est coordinateur de la tournée de conférences distinguées ComSoc(DLT/DSP). Il a participé à de nombreuses conférences nationales et internationales; telles que Microwave Theory & Technology (MTT)-2012 et ICC-2021. A contribué activement au développement de la normalisation IEEE 802.16.

Il est professeure associé affilié à l'Université Concordia, où il a enseigné pendant de nombreuses années en tant qu'enseignant et chercheur à temps partiel.

Il préside le chapitre de la section sur la communication et théorie de l'information et a joué un rôle déterminant dans l'obtention du prix Nord Amérique et du prix «Chapitre de l'année 2012» de ComSoc. Il a reçu le prix IEEE MGA Leadership Award-2008. Il a remporté le Prix l'IEEE 2014 J.J. Archambault pour l'est du Canada. Il a dirigé la section de Montréal pour remporter le prix de la grande section de l'IEEE Canada en 2008. ■

2019 IEEE CANADA M.B. BROUGHTON CENTRAL CANADA MERIT MEDAL
MÉDAILLE D'EXCELLENCE M.B. BROUGHTON DU CENTRE DU CANADA DE L'IEEE CANADA 2019

For the advancement of smart power integrated circuit technology
Pour l'avancement de la technologie des circuits intégrés intelligents

Dr. Wai Tung Ng, Toronto, ON

Wai Tung Ng received his B.A.Sc., M.A.Sc. and Ph.D. degrees in electrical engineering from the University of Toronto, in 1983, 1985 and 1990, respectively. He is a first-generation immigrant from Hong Kong. In 1990, Dr. Ng joined the Semiconductor Process and Development Center of Texas Instruments, Dallas, TX, to work on power devices for automotive applications. His academic career started in 1992 with the Department of Electrical and Electronic Engineering, at the University of Hong Kong. Dr. Ng returned to the University of Toronto in 1993. He was promoted to associate professor in 1998 and full professor in 2008.

Prof. Ng's volunteer services with the IEEE Toronto Section started in 2000 as the student activity chair. Since then, he has served as the vice Section chair (2008–2009) and Section chair (2010–2011). He was also the general chair for CCECE 2011. In the past 9 years (2009–2018), Prof. Ng worked as an associate editor for *IEEE Electronic Device Letters*. He is currently chairing the Technical Committee in Power Devices and ICs for

the IEEE Electron Devices Society. Prof. Ng has been on the organizing committees for many international conferences. More notably, he has a long-term involvement with the International Symposium on Power Semiconductor Devices and ICs (ISPSD) for over 15 years.

Prof. Ng is the director of the Toronto Nanofabrication Centre, an open access research facility at the University of Toronto since 2014. He is also leading the Smart Power Integration & Semiconductor Devices Research Group in Toronto. His research interests are in smart power ICs, power management ICs, smart gate driver ICs, integrated DC-DC converters, silicon and GaN power semiconductor devices. ■

Wai Tung Ng a reçu ses diplômes B.A.Sc., M.A.Sc. et doctorat en génie électrique de l'Université de Toronto, en 1983, 1985 et 1990, respectivement. Il est un immigrant de première génération originaire de Hong Kong. En 1990, Dr. Ng a rejoint le centre t de traitement et de développement des semiconducteurs de Texas Instruments, à Dallas, au Texas, pour travailler sur les dispositifs d'alimentation destinés aux applications automobiles. Sa carrière universitaire a débuté en 1992 au Département de génie électrique et électronique de l'Université de Hong Kong. Dr. Ng est retourné à l'Université de Toronto en 1993. Il a été promu professeure agrégé en 1998 et professeure titulaire en 2008.

Les services bénévoles du professeure Ng auprès de la section IEEE de Toronto ont commencé en 2000 en tant que président des activités pour les étudiants. Depuis lors, il a été vice-président de la section (2008–2009) et président de la section (2010–2011). Il était également Président de la conférence de la CCGÉI 2011. Au cours des 9 dernières années (2009–2018), Dr. Ng a travaillé comme éditeur associé aux lettres des appareils électroniques de l'IEEE. Il préside actuellement le comité technique sur les dispositifs d'alimentation et les circuits intégrés de la société de dispositifs électroniques de l'IEEE. Le professeure Ng a siégé aux comités organisateurs de nombreuses conférences internationales. Plus particulièrement, il participe depuis plus de 15 ans au Symposium International sur les Dispositifs à Semi-conducteurs d'Énergie et les Circuits Intégrés (SIDSÉCI).

Le professeure Ng est directeur du centre de nanofabrication de Toronto, une installation de recherche ouverte à l'Université de Toronto depuis 2014. Il dirige également le groupe de recherche sur l'Intégration Intelligente d'Énergie et des Dispositifs à Semiconducteurs à Toronto. Ses recherches ortent sur les circuits intégrés d'alimentation intelligents, les circuits de gestion d'Énergie, les circuits intégrés de commande de porte intelligente, les convertisseurs CC / CC intégrés, les dispositifs à semi-conducteurs d'énergie au silicium et au GaN. ■

2019 IEEE CANADA J.J. ARCHAMBAULT EASTERN CANADA MERIT MEDAL
MÉDAILLE D'EXCELLENCE J.J. ARCHAMBAULT DE L'EST DU CANADA DE L'IEEE CANADA 2019

For his exceptional volunteering, contributions and guidance supporting engineering innovation in Québec and to the IEEE Montréal Section as its executive committee secretary and treasurer from 2013–2017
Pour son bénévolat exceptionnel, contributions et conseils en appui à l'innovation en génie au Québec et à la Section IEEE Montréal en tant que secrétaire et trésorier du comité exécutif de 2013 à 2017

Dr. Frédéric Nabki, Montréal, QC

Frederic Nabki received the B.Eng. degree (Hons.) in electrical engineering and the Ph.D. degree in electrical engineering from McGill University, Montréal, QC, Canada, in 2003 and 2010, respectively. In 2008, he joined the Université du Québec à Montréal, where he was an associate professor in microelectronics engineering. In 2016, he joined the École de Technologie Supérieure, Montréal, a constituent of the University of Quebec, as an associate professor in the Department of Electrical Engineering. His research interests include microelectromechanical systems (MEMS) and analog, radiofrequency, and mixed-signal integrated circuits (ICs), specifically focusing on the creation of next generation MEMS processes and devices, the integration of MEMS devices with microelectronic systems, the modeling of MEMS devices, and the design of integrated circuits such as analog to digital converters, sensor interfaces, and ultra-wideband wireless transceivers. He has coauthored two book chapters and over a hundred scientific publications. He holds eleven issued patents and ten pending patent applications related to MEMS, ICs, and ICs/MEMS monolithic integration.

Through his research projects, Prof. Nabki introduced the first silicon carbide surface micromachining technology enabling

above-IC resonators and transducers, a disruptive ultra-wideband wireless transceiver technology, and unique monolithic laterally movable MEMS with integrated silicon nitride waveguides for optical communication systems. These innovations are currently being commercialized by MEMS Vision Inc., stemming from his Ph.D., SPARK Microsystems Inc., which he cofounded and was awarded the Nokia Innovation Challenge Award in 2018 at Bell Labs, and Aeponyx Inc., with which he collaborates through R&D efforts.

Prof. Nabki is a member of the Communications and Microelectronic Integration Laboratory (LACIME) at ETS, and was a cofounder of the institutional Research Centre on the Co-design and Fabrication of Microsystems at UQAM (CoFaMic). He also jointly manages the Microtechnology and Microsystems Laboratory (Micro2). He served as the secretary and treasurer of the

Frédéric Nabki a reçu le B.Ing. diplôme (Hons.) en génie électrique et le doctorat diplôme en génie électrique de l'Université McGill, Montréal, QC, Canada, en 2003 et 2010, respectivement. En 2008, il s'est joint à l'Université du Québec à Montréal où il était professeure agrégé en génie microélectronique. En 2016, il s'est joint à l'École de technologie supérieure de Montréal, un constituant de l'Université du Québec, à titre de professeure agrégé au département de génie électrique. Ses intérêts de recherche comprennent les microsystèmes électromécaniques (MEMS) et les circuits intégrés (CIs) analogiques, radiofréquences et mixtes, se concentrant plus particulièrement sur la création de procédés et de dispositifs MEMS de prochaine génération, l'intégration des dispositifs MEMS aux systèmes microélectroniques, la modélisation des dispositifs MEMS et la conception de circuits intégrés tels que les convertisseurs analogiques/numériques, les circuits d'interfaces de capteurs et les émetteurs/récepteurs sans fil à bande ultra large. Il est co-auteur de deux chapitres de livres et de plus d'une centaine de publications scientifiques. Il détient onze brevets délivrés et dix demandes de brevets en instance touchant aux MEMS, CIs et à l'intégration monolithique CIs/MEMS.

Dans le cadre de ses projets de recherche, le professeure Nabki a introduit la première technologie de micro-usinage de surface du carbure de silicium permettant l'utilisation de résonateurs et de transducteurs sur CIs, une technologie d'émetteur-récepteur sans fil à bande ultra-large novatrice et des MEMS monolithiques uniques à déplacement latéral avec guides d'ondes intégrés en nitrure de silicium pour les systèmes optiques de communication. Ces innovations sont actuellement commercialisées par MEMS Vision inc., issue de son doctorat, SPARK Microsystems inc., qu'il a cofondée et qui a reçu le Nokia Innovation Challenge Award en 2018 aux Bell Labs, et Aeponyx inc. avec laquelle il collabore dans le cadre de ses efforts en R&D.

Le professeure Nabki est membre du Laboratoire de communication et d'intégration de la microélectronique (LACIME) à l'ETS et a été cofondateur du Centre de recherche institutionnel sur la conception et la fabrication de microsystèmes (CoFaMic) à l'UQAM. Il dirige également conjointement le Laboratoire de microtechnique et de microsystèmes (Micro2). Il a été secrétaire et trésorier de la section montréalaise de l'IEEE de 2013 à 2017 et a été responsable des arrangements locaux de plusieurs conférences internationales de l'IEEE tenues à Montréal : ISCAS 2016, NEWCAS 2012 & 2018 et Life Sciences

Montréal Section of the IEEE from 2013 to 2017 and was local arrangement chair of several international IEEE conferences held in Montréal: ISCAS 2016, NEWCAS 2012 & 2018 and Life Sciences Conference 2018. Moreover, he was a TPC member of the NEWCAS conference between 2013 and 2019.

Professor Nabki was a recipient of the Governor General of Canada's Academic Bronze Medal and the UQAM Faculty of Science Early Career Research Award. He holds or has held financial support from the Microsystems Strategic Alliance of Quebec (ReSMiQ), the Quebec Fund for Research in Nature and Technology (FRQNT), the Ministry of Economy, Science and Innovation (MESI) of Quebec, the Natural Sciences and Engineering Research Council of Canada (NSERC), and the Canada Foundation for Innovation (CFI). ■

Conference 2018. De plus, il a été membre du TPC de la conférence NEWCAS entre 2013 et 2019.

Le professeure Nabki a reçu la Médaille de bronze académique du Gouverneur général du Canada et le Prix de la recherche volet relève de la Faculté des sciences de l'UQAM. Il détient ou a reçu l'appui financier du Réseau Stratégique en Microsystèmes du Québec (ReSMiQ), du Fonds de recherche du Québec – Nature et technologies (FRQNT), du ministère de l'Économie, des Sciences et de l'Innovation (MESI) du Québec, du Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG) et de la Fondation canadienne pour l'innovation (FCI). ■

IEEE Canada Members Elevated (2019) IEEE Fellows
Membres de l'IEEE Canada Sélectionnés Fellows IEEE (2019)

SONIA AISSA
For contributions to design and performance analysis of cognitive radio and cooperative communication systems

J. STEWART AITCHISON
For contributions to nonlinear optical devices and point-of-care testing systems

PAUL CHOW
For contributions to the programmability of field-programmable gate array-based computing

TIMOTHY N. DAVIDSON
For contributions to optimization of signal processing and communication systems

TAYEB A. DENIDNI
For contributions to frequency-selective surfaces and their application to reconfigurable antennas

MARK S. FOX
For contributions to constraint-directed reasoning and ontologies

REUVEN GORDON
For contributions to nanoaperture optical manipulation for protein and nanoparticle analysis

AHMED E. HASSAN
For contributions to the quality assurance of large-scale software systems

PIN-HAN HO
For contributions to failure restoration in optical backbone networks

HANS-ARNO JACOBSEN
For contributions to publish-subscribe and event processing

SRINIVASAN KESHAV
For contributions to fair queueing techniques and flow-control algorithms in computer networks

XIAOPING PETER LIU
For contributions to system identification and networked teleoperation

DEREK A. MCNAMARA
For contributions to antenna synthesis and engineering

ROBERT N. ROHLING
For contributions to ultrasound for medical diagnosis and intervention

PAUL VANOORSCHOT
For contributions to applied cryptography and authentication

IEEE Fellows
The IEEE grade of Fellow is conferred by the IEEE Board of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. A brief citation is issued to new Fellows describing their accomplishments, and the total number selected in any one year does not exceed one-tenth percent of the total voting Institute membership.

Fellows de l'IEEE
Le titre de Fellow de l'IEEE est décerné par le IEEE Conseil d'administration à une personne ayant un profil extraordinaire de réalisations dans l'un des domaines d'intérêt de l'IEEE. Une brève citation est émise aux nouveaux Fellows décrivant leurs réalisations; le nombre total de nouveaux Fellows sélectionnés dans une année ne dépasse pas un dixième de pourcent du nombre total de members de l'IEEE.

IEEE Canada Members Awarded an IEEE Technical Field Award (2019)
Membres de l'IEEE Canada Récipiendaires d'un Prix de Secteur Technique (2019)

2019 IEEE Gustav Robert Kirchhoff Award
KENNETH MARTIN

2019 IEEE Charles Proteus Steinmetz Award
INNOCENT KAMWA

Prix Gustav Robert Kirchhoff IEEE 2019
KENNETH MARTIN

Prix IEEE Charles Proteus Steinmetz 2019
INNOCENT KAMWA

IEEE Canada Members Elected EIC Fellows (2019)
Membres de l'IEEE Canada Élus Fellows ICI (2019)

ALAGAN ANPALAGAN—Toronto Section

FAKHREDDINE KARRAY—Kitchener-Waterloo Section

BRIAN WILLIAM SURGENOR—Kingston Section

LAURENCE TIANRUO YANG—CAS Section

HALIM YANIKOMEROGLU—Ottawa Section

YANG SHI—Victoria Section

Killam Prizes (2019)

KEITH W. HIPEL
Engineering
University of Waterloo

Prix Killam (2019)

KEITH W. HIPEL
Génie
Université de Waterloo

IEEE Canada Exemplary Small Section Award 2019	Le Prix Exemplaire de l'IEEE Canada de la petite Section 2019
London	
"For Good Section Leadership, Management and Administration during 2018"	"Pour le Bon leadership, la Gestion et l'Administration de la Section en 2018
IEEE Canada Exemplary Medium Section Award 2019	**Le Prix Exemplaire de l'IEEE Canada de la moyenne Section 2019**
Windsor	
"For Good Section Leadership, Management and Administration during 2018"	"Pour le Bon leadership, la Gestion et l'Administration de la Section en 2018"
IEEE Canada Exemplary Large Section Award 2019	**Le Prix Exemplaire de l'IEEE Canada de la grande Section 2019**
Montréal	
"For Good Section Leadership, Management and Administration during 2018"	"Pour le Bon leadership, la Gestion et l'Administration de la Section en 2018"
Toronto	
"For Good Section Leadership, Management and Administration during 2018"	"Pour le Bon leadership, la Gestion et l'Administration de la Section en 2018 "

ICF Prizes and Scholarships

The IEEE Canadian Foundation, a registered charity in Canada, is the philanthropic partner of IEEE in Canada. Donations support scholarships and prizes as well as McNaughton Learning Resource Centres and grants to new and innovative initiatives. The IEEE Canadian Foundation welcomes directed gifts from individuals, associations, corporations, and foundations. These are used to endow annual awards that meet worthy but unfilled needs and further the purpose of the donor and the IEEE Canadian Foundation. More information at: www.ieeecanadianfoundation.org

EEE Canada Women in Engineering Prize 2018

MANAR JAMAL—London Section

IEEE Canada Power Quality Scholarship 2018

AUSTYN NAGRIBIANKO—University of Calgary

IEEE Canadian Foundation Scholarships 2018

ALEXANDRE POERSCH—University of Manitoba
PETER MACK—University of Alberta
VINCENT PHAN—McMaster University
RYAN ABRAHAM—Carleton University
EDUARD TOURANI—University of Calgary

Dr. Raymond D. Findlay Scholarship 2018

ILIJA HRISTOVSKI—University of British Columbia Okanagan

IEEE Canadian Foundation Nick Cercone Graduate Scholarship in Computer Science 2018

EHSAN SHERKAT—Dalhousie University

IEEE Canada Student Awards 2018

George Armitage Best Student Branch Award
Ryerson University

Website Competition:
1st Place: University of Toronto
2nd Place: Ryerson University and Memorial University of Newfoundland
3rd Place: British Columbia Institute of Technology (BCIT)

IEEE Canada WIE and YP Awards 2018

IEEE WIE Canada Group of the Year Award, Small-Medium Section
Winnipeg WIE Group

IEEE WIE Canada Group of the Year Award, Large Section
Vancouver WIE Group

IEEE YP Canada Group of the Year Award
Vancouver YP Group

In Memoriam

Friends We Have Lost

Mo El-Hawary

IEEE Canada mourns the loss of Mohamed "Mo" El-Aref El-Hawary, who passed away on Friday 26 July 2019 in Halifax, Nova Scotia. He was the president of IEEE Canada from 2002 to 2003. He was an active volunteer who held many high-level positions throughout the organization.

Dr. El-Hawary was a professor of electrical and computer engineering at Dalhousie University in Halifax. He received his B.Sc. in electrical engineering, with distinction and first class honors, from the University of Alexandria, Egypt, in 1965, and his Ph.D. in electrical engineering from the University of Alberta, Edmonton, in 1972, where he was an Izaak Walton Killam Memorial Fellow from 1970 to 1972. He was an associate professor of electrical engineering at the Federal University of Rio de Janeiro, Brazil, for two years and subsequently served on the faculty at Memorial University of Newfoundland from 1974 to 1982. He was appointed the chairman of its Electrical Engineering Program in 1976. In 1981, he joined the Technical University of Nova Scotia (TUNS) as a professor of electrical engineering. In 1997, TUNS merged with Dalhousie University. Dr. El-Hawary was the associate dean of engineering at Dalhousie between 1995 and 2007, director of international and external relations for the faculty of engineering (2008–2009), and chair of the senate of Dalhousie University (2001–2007). He cherished having had the opportunity to be part of educating, mentoring, and touching the lives and careers of countless students in the field of electrical engineering over his long and distinguished career.

Throughout his career, Dr. El-Hawary authored more than 10 textbooks and close to 200 full journal papers. He was the editor of IEEE Press Power Engineering Series and the founding editor-in-chief of *IEEE Systems Man and Cybernetics Magazine* and *IEEE Power Engineering Letters*. He was the associate editor for the three major IEEE electric machines and power systems journals and the editor of *Electrical Power Engineering* and *The McGraw-Hill Encyclopedia of Science and Technology*. He was a Fellow of the IEEE, the Canadian Academy of Engineering, Engineers Canada, and the Engineering Institute of Canada. He was a Distinguished Lecturer of the IEEE Power & Energy Society (PES).

Dr. El-Hawary served as a member on the IEEE Board of Directors, as IEEE secretary, and as IEEE Canada president. He served on the IEEE Publication Services and Products Board, the IEEE Fellows Committee, the IEEE Press Board chair, the IEEE Power Engineering Society System Operations Committee chair, as the vice-president of Development for IEEE Canada, and was a member of the IEEE HKN Board. In 2010, he received the IEEE Canada W.S. Read Service Award. In 1999, he received the IEEE Educational Activities Board Meritorious Achievement Award, the IEEE PES Outstanding Power Engineering Educator Award, and the IEEE Canada A.G.L. McNaughton Gold Medal.

Grampy Mo, as he was known to his family, was a great lover of animals, classical music, politics, traveling, and taking selfies. He was also a devoted father, grandfather, brother, and friend. He especially enjoyed being with family and friends and making

IEEE Canada déplore le décès de Mohamed «Mo» El-Aref El-Hawary, décédé le vendredi 26 juillet 2019 à Halifax, Nouvelle-Écosse, Canada. Il a été président de l'IEEE Canada de 2002 à 2003. Il était un bénévole actif qui a occupé de nombreux postes de haut niveau dans toute l'organisation.

Monsieur El-Hawary était professeur de Génie Électrique et informatique à la Dalhousie University à Halifax, en Nouvelle-Écosse, au Canada. Il avait un B.Sc. en génie électrique, mention très bien, mention très bien, Université d'Alexandrie (Egypte), 1965, et son doctorat en génie électrique, Université de l'Alberta, Edmonton, en 1972, où il a été boursier Izaak Walton Killam Memorial de 1970 à 1972. Il a été professeur associé en génie électrique à l'Université fédérale de Rio de Janeiro pendant deux ans. professeur à l'Université Memorial de Terre-Neuve depuis 1974. Il a été nommé président du programme de génie électrique en 1976. En 1981, il s'est joint à l'Université technique de la Nouvelle-Écosse (TUNS) en tant que professeur de génie électrique. En 1997, TUNS a été fusionnée avec l'Université Dalhousie. M. El-Hawary a été doyen associé du génie à Dalhousie de 1995 à 2007, directeur des relations internationales et externes à la Faculté de génie 2008-2009 et président du Sénat de l'Université Dalhousie de 2001 à 2007. Au cours de sa longue et distinguée carrière, il a eu la chance de pouvoir participer à l'éducation, au mentorat et à la vie et à la carrière d'innombrables étudiants dans le domaine du génie électrique.

Au cours de sa carrière, Mo a écrit plus de dix manuels scolaires et près de 200 articles de journaux complets. Il a été rédacteur en chef de la série technique de presse de l'Institut d'ingénierie électrique et électronique (IEEE), rédacteur en chef fondateur du magazine IEEE Systems Man et de la cybernétique, Power Letter of PES. Il a été rédacteur en chef adjoint pour les trois principaux journaux de Machines électriques et systèmes électriques et rédacteur en chef, ingénierie de l'énergie électrique, de l'encyclopédie des sciences et technologies McGraw-Hill. Il a été membre de l'IEEE, de l'Académie canadienne du génie, d'Ingénieurs Canada et de l'institut d'ingénierie du Canada. Il a été conférencier émérite de la société de l'énergie et de l'électricité de l'IEEE.

Il a été membre du conseil d'administration et secrétaire de l'IEEE, ainsi que Président de l'IEEE Canada. Il a siégé au conseil des produits et publications de l'IEEE, comité des boursiers, président du conseil de presse de l'IEEE, Power Engineering Society (PES): président du comité des opérations système, membre du conseil d'administration de HKN et vice-président du développement, Fondation de l'IEEE Canada. Il a reçu le prix de service W. S. Read de l'IEEE Canada en 2010. En 1999, l'IEEE lui a décerné le prix EAB Meritorious Achievement, éducateur de l'année en génie énergétique, et la médaille d'or IEEE Canada General A.G.L McNaughton.

Grampy Mo, comme l'appelle sa famille, était un grand amateur d'animaux, de musique classique, de politique, de voyages et de "selfies". Il était également un père, un grand-père, un frère et un ami dévoué. Il aimait particulièrement être avec sa famille et ses amis et les faire rire et sourire au Canada et lors de voyages partout dans le monde. Il aimait passer le plus de temps possible

them all laugh and smile, both at home and during his travels around the world. He enjoyed spending as much time as possible with the love of his life, Nanny Fifi, with whom he shared numerous adventures in exotic locations worldwide. Their favorite place to spend time together was their cottage at White Point Beach, Nova Scotia, where they will eventually lie together for eternity.

The following are excerpts from the *IEEE Spectrum* article "Paying tribute to former IEEE Canada President Mo El-Hawary" by Kathy Pretz (https://spectrum.ieee.org/the-institute/ieee-member-news/paying-tribute-to-former-ieee-canada-president-mo-elhawary):

- "IEEE was his second family, a family he believed strongly in. The IEEE and our community of volunteers have lost an important member. IEEE was a big part of Mo's life, and Mo was a big part of IEEE." —IEEE Canada President Maike Luiken.
- "Mo was consistently active in IEEE Region 7 during the more than 20 years that I knew him. He organized many events and encouraged a tremendous number of people to volunteer. In fact, it is very impressive that within the last few weeks of his life he contacted me with questions about the process of nominating people for awards." —IEEE Fellow and Past President Celia Desmond.
- "Mo was always ready with cheerful and relevant anecdotes to enliven meetings and personal conversations. He took on various tasks supporting the philanthropic purposes of the IEEE Canadian Foundation, including taking the lead in updating its promotional materials." —IEEE Canadian Foundation President David Whyte.
- "Dr. El-Hawary advocated passionately to secure the future of IEEE's book program, particularly for its benefits to members as a source of practical knowledge and technical currency." —IEEE Book and Information Services Director Ken Moore.
- "Mo's service to the profession, to students, to IEEE, is enormous. From a personal perspective—as a fellow volunteer—I always felt privileged to be connected with him. His leadership and dedication to IEEE and to the section were inspirational and telling for many of us. In that sense, those cryptic four letters on the El-Hawary van's license plate, IEEE, speak volumes." —IEEE Canadian Atlantic Section Chair Dirk Werle.

Dr. El-Hawary is survived by his wife, Ferial, an IEEE Life Fellow and dedicated volunteer, and by three children, eight grandchildren, and two sisters. Donations in Mo El-Hawary's memory can be made to the IEEE Canadian Foundation. ■

avec l'amour de sa vie (Nanny Fifi) avec qui il a partagé des aventures dans des lieux exotiques du monde entier. Leur lieu de prédilection est leur chalet à White Point Beach, en Nouvelle-Écosse, où ils finiront par se coucher pour l'éternité.

Extraits d'un article récent sur IEEE Spectrum, «Un hommage à l'ancien président de l'IEEE Canada, Mo El-Hawary» - par Kathy Pretz

- Maike Luiken, présidente de l'IEEE Canada: «L'IEEE était sa deuxième famille, une famille en laquelle il croyait fermement. L'IEEE et notre communauté de bénévoles ont perdu un membre important. L'IEEE a joué un rôle important dans la vie de Mo et Mo a joué un rôle important dans l'IEEE.»
- Celia Desmond, membre et ancienne présidente de l'IEEE: «Mo a toujours été actif dans la région IEEE 7 pendant plus de 20 ans que je l'ai connu. Il a organisé de nombreux événements et encouragé un nombre considérable de personnes à faire du bénévolat. En fait, il est très impressionnant qu'au cours des dernières semaines de sa vie, il m'ait contacté pour me poser des questions sur le processus de nomination de personnes aux prix.»
- David Whyte, président de la Fondation canadienne de l'IEEE: «Mo était toujours prêt avec des anecdotes gaies et pertinentes pour animer des réunions et des conversations personnelles. Il a assumé diverses tâches liées aux objectifs philanthropiques de la Fondation canadienne de l'IEEE, notamment la mise à jour de son matériel promotionnel.»
- Ken Moore, directeur des services du livre et de l'information de l'IEEE: «Monsieur. El-Hawary a plaidé avec passion pour assurer l'avenir du programme du livre de l'IEEE, en particulier pour ses avantages pour les membres en tant que source de connaissances pratiques et de technicité.»
- Dirk Werle, président de la section canadienne Atlantique de l'IEEE: «Le service de Mo à la profession, aux étudiants et à l'IEEE est énorme. D'un point de vue personnel, en tant que bénévole, je me suis toujours senti privilégié d'être en contact avec lui. Son leadership et son dévouement envers l'IEEE et la section ont été une source d'inspiration pour beaucoup d'entre nous. En ce sens, ces quatre lettres énigmatiques sur la plaque d'immatriculation de la fourgonnette El-Hawary, IEEE, en disent long.»

Monsieur El-Hawary laisse derrière lui son épouse, Ferial, boursière à Vie de l'IEEE et également volontaire dévouée, ainsi que trois enfants, huit petits-enfants et deux soeurs. Des dons à la mémoire de Mo El-Hawary peuvent être versés à la Fondation canadienne de l'IEEE. ■

Prabha Shankar Kundur

Prabha Shankar Kundur, a well-known and influential figure in the electric power industry, passed away on Tuesday, 9 October 2018. In 1967, Dr. Kundur received his Ph.D. degree in electrical engineering from the University of Toronto, Ontario, and spent more than 40 years in the power utility sector. He served in a variety of leadership roles, including most recently as the president of Kundur Power System Solutions Inc., Toronto.

From 1994 to 2006, he served as the president and chief executive officer of Powertech Labs Inc., the research and technology subsidiary of BC Hydro. Prior to joining

Prabha Shankar Kundur, une figure bien connue et influente du secteur de l'Énergie Électrique, est décédée le mardi 9 octobre 2018. Il a reçu son doctorat diplômé en génie électrique en 1967 de l'Université de Toronto et a passé plus de 40 ans dans le secteur des services publics d'électricité. Il a occupé divers postes de direction, notamment en tant que président de Kundur Power System Solutions Inc., à Toronto, au Canada.

De 1994 à 2006, il a été président et chef de la direction de Powertech Labs Inc., filiale de recherche et technologie de BC Hydro. Avant de rejoindre Powertech, il a travaillé pour Ontario Hydro pendant près de 25 ans et a occupé des postes de responsabilité dans la planification et la conception de

Powertech Labs, he worked at Ontario Hydro for nearly 25 years and held senior positions that involved power system planning and design. Throughout his career, he held a variety of adjunct professor roles, including at the University of Toronto and the University of British Columbia. He authored the well-known book *Power System Stability and Control* (McGraw-Hill, 1994).

Dr. Kundur had an extensive record of service and leadership in the IEEE. He chaired numerous committees and working groups of the IEEE PES and was elected a Fellow of the IEEE in 1985. He served as the chair of the IEEE Power System Dynamic Performance Committee from 2001 to 2003. From 2004 to 2010, he served as a member of the IEEE PES Executive Committee and as the PES vice-president for Education. He is the recipient of several IEEE awards, including the IEEE Nikola Tesla Award (1997), the IEEE PES Charles Concordia Power System Engineering Award (2005), and the IEEE Medal in Power Engineering (2010).

Dr. Kundur was elected as a Fellow of the Canadian Academy of Engineering in 2003 and as a Foreign Member of the U.S. National Academy of Engineering in 2011. He was awarded two honorary degrees: Doctor Honoris Causa by the University Politechnica of Bucharest, Romania, in 2003 and Doctor of Engineering, Honoris Causa by the University of Waterloo, Canada, in 2004. To recognize his technical leadership, in 2012, the IEEE PES Prabha S. Kundur Power System Dynamics and Control Award was established in his honor.

He was also very active in CIGRE for many years, serving as chair of the CIGRE Study Committee C4 on System Technical Performance from 2002 to 2006 and as a member of the CIGRE Administrative Council from 2006 to 2010. He was the recipient of the CIGRE Technical Committee Award in 1999 and was awarded the CIGRE Medal in 2014.

Dr. Kundur was a loving and devoted husband to Geetha Kundur for 55 years and a doting grandfather to Linus and Ptolemy, for whom he purchased gifts and took on family vacations around the world. He was especially proud of his daughter, Deepa Kundur, who in many ways followed his example. ■

systèmes électriques. Au cours de sa carrière, il a occupé divers postes de professeur auxiliaire, notamment à l'Université de Toronto et à l'Université de la Colombie-Britannique. Il est l'auteur du livre bien connu: *Power System Stability and Control* (McGraw-Hill, 1994).

Monsieur Kundur avait une longue expérience de service et de leadership dans l'IEEE. Il a présidé de nombreux comités et groupes de travail de la société IEEE Power & Energy. Il a été élu membre de l'IEEE en 1985. Il a présidé le comité de performance dynamique du système d'alimentation de l'IEEE de 2001 à 2003. De 2004 à 2010, il a été membre du comité exécutif du PSE de l'IEEE et vice-président du PSE. -Président pour l'éducation. Il a reçu plusieurs prix IEEE, notamment le prix IEEE Nikola Tesla 1997, le prix IEEE PES 2005 Charles Concordia pour l'ingénierie des systèmes électriques et la médaille IEEE 2010 en ingénierie énergétique. Monsieur Kundur a été élu membre de l'Académie canadienne du génie en 2003 et membre étranger de la National Academy of Engineering en 2011. Il a reçu deux diplômes honorifiques: Doctor Honoris Causa de l'Université Politechnica de Bucarest, en Roumanie. en 2003 et docteur en ingénierie, honoris causa de l'Université de Waterloo, au Canada, en 2004. Pour récompenser son leadership technique, le prix IEEE PES Prabha S. Kundur pour la dynamique et le contrôle du système d'alimentation a été créé en 2012. Monsieur Kundur a également été très actif au CIGRE pendant de nombreuses années. Il a présidé le comité d'étude C4 du CIGRE sur la «performance technique du système» de 2002 à 2006 et a été membre du conseil d'administration du CIGRE de 2006 à 2010. Il a reçu le prix du comité technique du CIGRE en 1999. Il a a reçu la médaille CIGRE en 2014.

Monsieur Kundur était un mari affectueux et dévoué pour Geetha Kundur pendant 55 ans et une grande joie pour ses petits-enfants, Linus et Ptolemy, pour qui il avait pris des vacances en famille et apporté des cadeaux du monde entier. Il était particulièrement fier de sa fille, Deepa Kundur, qui a suivi son exemple à bien des égards. ■

Azizur Rahman

Dr. Azizur Rahman, Life FIEEE, passed away on 16 June 2018 in St. John's, Newfoundland, surrounded by his family. Dr. Rahman joined Memorial University in 1976 and remained an active and dedicated educator and researcher until the time of his passing.

Dr. Rahman was born in Santahar, Bangladesh, on 9 January 1941 and came to Canada as a Commonwealth Scholar to study electrical engineering at the University of Toronto. Over the next 54 years, he made substantial contributions to the field of engineering as a leader, teacher, researcher, and consultant, and published more than 600 papers and coauthored multiple books. He gained international recognition for solving problems in the design, manufacture, and practical application of permanent magnet motors. He is best known for developing the first self-start, high-efficiency, and high power-factor interior permanent magnet motor, which enabled Toyota to launch the first mass-produced, commercially successful hybrid electric motor vehicle, the Prius.

He is a Fellow of the Royal Society of Canada and the first Canadian to receive the highest awards from all the Societies of the IEEE. He was a Life Fellow of the IEEE and the Institution of Engineering in the United Kingdom and Bangladesh. He was

Monsieur Azizur Rahman, de FIEEE à Vie, est décédé le 16 juin 2018 à St. John's, à Terre-Neuve, entouré de sa famille. Le Dr Rahman a rejoint l'Université Memorial en 1976 et est resté un éducateur et chercheur actif et dévoué jusqu'au moment de son décès. Monsieur Rahman est né à Santahar, au Bangladesh, le 9 janvier 1941 et est venu au Canada à titre de boursier du Commonwealth pour étudier en Génie Électrique à l'Université de Toronto. Au cours des 54 années suivantes, il a apporté une contribution substantielle au domaine de l'ingénierie en tant que leader, enseignant, chercheur et consultant, et a publié plus de 600 articles et co-écrit de nombreux ouvrages. Il a acquis une reconnaissance internationale pour avoir résolu des problèmes de conception, de fabrication et d'application pratique de moteurs à aimants permanents. Monsieur Rahman est surtout connu pour avoir mis au point le premier moteur à aimant intérieur à auto-démarrage, rendement élevé et facteur de puissance élevé, qui a permis à Toyota de lancer le premier véhicule à moteur électrique hybride fabriqué en série et à succès commercial, «The Prius». Il est membre de la Société royale du Canada et le premier Canadien à recevoir les plus hautes distinctions de toutes les sociétés de l'IEEE. Il était membre à vie de l'IEEE, de l'Institution of Engineering au Royaume-Uni et au Bangladesh. Il était un fier Canadien et un ardent défenseur de l'égalité d'accès à l'éducation pour tous.

a proud Canadian and staunch believer in equal access to education for all.

He was the beloved husband of Alta for 55 years and loving father to Diana (Kevin) of San Francisco, Proton (Tanis Adey) of St. John's, Newfoundland, and Adam (Corrine) of London, Ontario. ■

Il a été le mari aimé d'Alta pendant 55 ans et le père bien-aimé de Diana (Kevin) de San Francisco, de Proton (Tanis Adey) de St. John's (Terre-Neuve) et d'Adam (Corrine) de London, Ontario. ■

Anne-Marie Sahazizian

Anne-Marie Sahazizian, Life SMIEEE, and an IEEE member for 39 years, passed away in Toronto, Ontario, on 13 September 2019. She was a member of the Toronto Section, an active volunteer for and leader of the IEEE Standards Association, and served on the Standards Board and on the Charles Proteus Steinmetz Award Committee. In 2012, Ms. Sahazizian was awarded the Standards Medallion "for major contributions to the development of standards." She was also a recognized leader at the International Council on Large Electric Systems (CIGRE). She worked as an electrical engineer for Ontario Hydro and Hydro One in Transformer Station Design and Standards.

Ms. Sahazizian was born to two survivors of the Armenian genocide in Bucharest, Romania, on 9 April 1946. She will be remembered by her husband of 56 years, Lanis, and her children, Anton (Laura) and Alice (Leonardo). Anne-Marie will also be lovingly missed by her five grandchildren: Antonia, Gabriela, Jack, Lilly, and Teddy. ■

Anne-Marie Sahazizian, Life SMIEEE, et membre de l'IEEE depuis 39 ans, est décédée à Toronto le 13 septembre 2019. Elle était membre de la section de Toronto, bénévole active et dirigeante de l'association de normalisation IEEE, et a comité de normalisation et du comité du prix Charles Proteus Steinmetz. En 2012, Anne-Marie a reçu le médaillon des normes pour ses contributions majeures au développement des normes. Elle était également une dirigeante reconnue du conseil international des grands systèmes électriques (CIGRE). Anne-Marie a travaillé en tant qu'ingénieur électricien pour Ontario Hydro et Hydro One dans la conception et les normes de postes de transformation.

Anne-Marie est née le 9 avril 1946 à Bucarest, en Roumanie, de deux survivants du génocide arménien. Son mari, 56 ans, Lanis, et ses enfants Anton (Laura) et Alice (Leonardo) se souviendront d'elle. Anne-Marie manquera également à ses cinq petits-enfants, Antonia, Gabriela, Jack, Lilly et Teddy. ■

Ukraine International Airlines Flight PS752 crash on January 8, 2020

IEEE Canada members mourn the loss of volunteers, members, and friends in the crash of Flight PS752. Our thoughts and sincere condolences are with all those who lost family members and friends in this horrific airplane crash.

L' accident du vol PS752 d'Ukraine International Airlines du 8 janvier 2020

Les membres de l'IEEE Canada pleurent la perte de bénévoles, de membres et d'amis dans l'écrasement du vol PS752. Nos pensées et nos sincères condoléances vont à tous ceux qui ont perdu des membres de leur famille et des amis dans cet horrible accident d'avion.

A Letter From Sweden

by Daryoush Shiri

Next time you hear "Sweden," instead of IKEA, ABBA, and Swedish meatballs, think of *Apollo 11*. Here's why: A firm owned by the Hasselblad family in Gothenburg, Sweden, built the cameras used by *Apollo 11* in its history-making mission. The pictures of the first human to walk on the moon's surface were captured by a 70-mm Hasselblad camera [1].

Here is another example of Swedish innovation. I used to wonder what was being made in that Svenska Kullagerfabriken (SKF) manufacturing plant beside Highway 401 in Milton, Ontario, which displayed the flags of Sweden and Canada in its parking lot. Well, that is one of many branches that SKF—meaning "Swedish ball bearing factory"—has around the world. The reduction of friction by using a layer of metallic spheres was invented by a Swedish engineer, Sven Wingquist, in 1907. Thereafter, he founded SKF here in Gothenburg [2]; now, you cannot name any form of machinery from around the world that does not use ball bearings.

Swedes are very creative and resourceful people, and this dates back to their long tradition of making the most of what their harsh Nordic climate can offer. If you are not yet as enthused as I am, let me add the invention of powdered milk, the safety seat belt, dynamite, and the discovery of many elements of the periodic table to the list. Also, do not forget Volvo, Scania, Saab, Ericsson, Husqvarna, Skype, and COMSOL.

I came to Sweden as a postdoctoral researcher, so it was quite natural to explore this country by first observing my new work environment: Chalmers University of Technology. My interview here in 2015 at the Physics Department, which was called *Teknisk Fysik* (*Engineering Physics*), was a very unique and memorable experience. I realized that this is a place where engineers and physicists understand each other. You can speak the language of each party, and you will be understood by both, whether it's the "tight-binding Hamiltonian" or the "graph incidence matrix of a circuit." Luckily, I was given an offer and didn't hesitate to

accept it right away, despite my fears and worries about crossing the Atlantic Ocean and those many "what ifs" a researcher couple may ask.

My first positive impression was learning that all graduate students, staff, and faculty members are entitled to offices of the same quality. There is no evidence of inequality in the distribution of workspaces depending on the rank, seniority, or budget of a research group. All offices have windows, as it is understood that winters are murky and the rest of the seasons are often cloudy.

Even laboratories that, due to unavoidable architectural features, have no access to windows are generously decorated with pictures of trees and flowers. This reduces the sense of being incarcerated in a box during the hours that students and teachers must spend there.

There is a strict set of rules in Sweden called *Arbetsmilijölagen* (*Working Environment Law*) [3] that requires employers to provide healthy and safe working environments for employees of every level. This is a very important factor in keeping the research workforce mentally and physically happy. Each employer has access to an Arbetsmilijölagen booklet outlining whom to call should something go wrong.

The Swedish government recommends that part of every public building budget be spent on the arts. Therefore, all department buildings, new or old, are decorated with artwork created by artists from both classical and contemporary disciplines. The same is true when you step into public libraries, hotels, and health centers. Extensive research by Jadwiga Krupinska, a professor of architecture at Royal Technical University in Stockholm, showed that the architecture of a school influences students' abilities to learn [4]. A pleasing design encourages students and teachers to stay longer and enjoy working and learning more.

Academic Culture

In addition to personal meetings with your immediate manager or research supervisor, there are weekly meetings (or seminars) where a few groups with very similar research interests sit together. One or two members of the group present a 30–45-minute seminar, followed by questions posed by senior professors. This can help students polish a paper before submitting it or increase the quality of a talk before presenting it at an upcoming conference. It forces graduate students and postdoctoral researchers to expand beyond their comfort zones by speaking about their work and exposing their research results to instructive criticism and revitalization.

In every department, group, or division, people gather on a weekly basis for an hour of drinking coffee and enjoying Swedish cookies and cakes that are brought by a volunteer colleague (or according to a periodic list of names). During this Fika Pause (coffee pause), the department head, graduate students, senior professors, young faculty members, and staff all sit together informally and chat socially. This helps you to get to know your colleagues better and learn about new departmental rules and decisions.

Every three or four months, the head of the department/division enters your office for a friendly chat about your research and progress. You can show him/her what you are doing or what you have just calculated, and, he/she asks if you have any personal issues, you can discuss whether your housing is okay, if you feel healthy, and so on. Importantly, he/she will ask about your plans after the postdoctoral years, give advice on how to apply for jobs, and even express a willingness to recommend you to companies or other research groups. For an international postdoctoral researcher, this is a very decent and generous act practiced by the head.

In addition to these informal visits, there is an annual evaluation session. You personally meet with the department head, and he/she evaluates your progress based on your research achievements—you are not evaluated only based on the number of your publications. Later, you are told how much your next year's salary will be raised based on your performance.

Every year, the president of the university invites all employees to complete a questionnaire. The questions cover issues such as racism and sexism at work, your concerns about your office space, your colleagues, your ideas about your immediate manager, and work–life balance, among others. The statistics are published a few months afterward, and there is a review session organized by the division/department head to discuss how issues can be avoided or resolved. This helps decision makers in the university involve everyone in problem solving, as a lack of feedback makes a system prone to instability and malfunctioning.

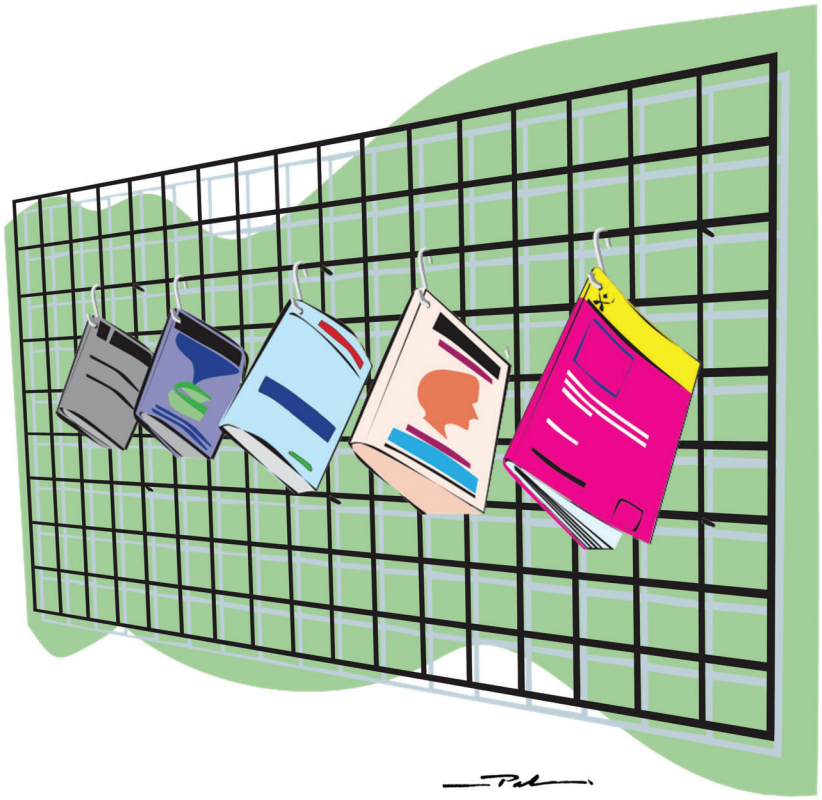
There is a tradition here at the Physics Department whereby everyone receives a newsletter with a nice foreword written by the department chair, who writes an interesting and fun-to-read short article that skillfully relates to a recent issue of interest in the department. It is amazing that a busy physicist with a huge administrative load manages to write a literary article. By reading it, you learn something new about the department or even something related to history, language, or literature that you previously knew nothing about. The department chair even shares with you which novel he or she has just finished reading. During my employment here at Chalmers, I have witnessed two consecutive department chairs in office who religiously practiced this culture of reaching out, writing, and talking to employees. Every Christmas, all employees receive physics toys, puzzles, and postcards from the chair as gifts. For graduate students and international postdoctoral researchers, these gestures provide a sense of belonging, respect, and appreciation.

My first positive impression was learning that all graduate students, staff, and faculty members are entitled to offices of the same quality.

The progressive atmosphere I'm describing has time-honoured roots. The culture, attitude, and experience of governing an organization called *university* by Swedes dates back to 1470. Furthermore, the practice of mentoring, housing, and paying a Ph.D. student dates back to 1728, when a poor, young student named Carl von Linné entered Uppsala University. Prof. Olof Celsius hired him, gave him a room at his house, and let him do his research on his vast botanical garden, after realizing von Linné's struggle with poverty and his genuine passion for learning.

Another cultural practice worth mentioning is that people keep the doors of their offices open all day long. Just enter and ask your question instead of shooting emails around.

When graduate students finish writing their thesis, they submit the PDF file to the university press (after the supervisor's approval). Then, the university prints and delivers 100 copies of the thesis to the student's office before his/her defense date. Attendees can receive a free copy during



the defense as a gift or keepsake. The expense of envelopes and postage stamps is covered by the university so that the student can send his/her thesis to anyone around the world, such as future employers or famous investigators in his/her thesis research area. This removes a huge burden and stress from the shoulders of students as they get closer to the defense deadline, especially if they are short of financial support during the last term.

A copy of the thesis is hung on a stand or a special wall designed for such purposes in each department or division. Feel free to take a thesis off the hook, take it home, read it, and return it. Ph.D. students graduate within four years unless they choose to teach, in which case, they have five years to finish. After publishing a few papers, they have this option of graduating as licentiate (Ph.D. sans dissertation) and going into industry. Let me also mention how formal, ceremonial, and majestic the Ph.D. defense sessions are. When I remember my own defense session—which looked like no more than a long weekly meeting—I feel jealous of the students here.

Another academic practice also fascinates me: When an assistant (associate) professor is promoted to associate (full professorship) level, he or she must present a public lecture. He/she will be introduced by the chair of the department, and the public will learn why he/she was promoted and about his/her research interests and achievements. After attending a student-friendly talk by the promoted faculty member, everyone enjoys coffee, cake, and champagne in his/her honour.

Newly hired faculty members are sent to Swedish-language courses, as they must attain mastery over three years to teach undergraduate courses. Prospective instructors are also offered courses on ethics, methods of supervising and advising graduate students, and pedagogy (teaching skills)—regardless of their academic merits and backgrounds. It is well understood here that being a top-notch researcher with many high-impact papers in your CV does not necessarily make you a top-notch mentor and a teacher. When a supervisor is not happy with a student's performance, there are procedures and rules for handling the situation respectfully and professionally. This involves seeking assistance from senior professors (if applicable) to help the student get out of the research pothole or referring the student to relevant help centers on campus. Faculty members are advised not to handle these cases with ad hoc methods, and they should not allow the criticism to become personal or undermine a student's confidence.

Faculty members respect their students and postdoctoral researchers as colleagues. Every day, you witness small and large research groups walking toward department restaurants for lunch. The lunchtime from 12:00 to 1:00 p.m. is used to enjoy a meal and have a friendly chat between senior professors (or even members of the Royal Swedish Academy) and their students. This atmosphere is very helpful in releasing stress from the brain of a student who has been in a clean room since early morning or a frustrated postdoctoral researcher who was trying to get a plot out of simulations.

Almost every department has its own restaurant, and every day at least three types of meals are offered for every taste: meat, fish, and vegetarian. In addition, there are lunchrooms in each department with access to free coffee, tea, and baskets of fruit. Faculty, staff, and graduate students can warm up their lunches in dozens of clean microwave ovens. On some Fridays, a live music concert is performed while everyone is having lunch. Undergraduate students are also provided these benefits with the same quality and quantity, except that they have to pay for their coffee.

In Chalmers, you never feel underappreciated or isolated. Your boss tells you, "Great job!" if you did so, and vice versa. International graduate students are entitled to enroll in Swedish-language courses, and the expense is covered by the supervisors. This helps students find a job here or in Scandinavia in general. Knowing one of the Nordic languages is an advantage when you apply for a job in Scandinavia.

Since an international Ph.D. student (as an employee) pays taxes and contributes to society, he/she is entitled to social benefits, such as employment insurance, which helps him/her get paid by some amount after graduation. This will give the graduated Ph.D. student some time to find a new job. This is immensely helpful and stress relieving, as the student might be worried about his/her visa status, financial status, and so on [5].

Ph.D. students at Chalmers are allowed to take extra courses outside of their research specialty to widen their skill set. Courses in pedagogy, rhetoric, management, or even linguistics are what a Ph.D. student can take to avoid being a one-dimensional person skilled only in a specific research area.

Graduate students can also choose to take a one-year intensive course on pedagogy and education in parallel to their studies. Then, they can apply for high school teacher positions. Due to the shortage of science teachers in Sweden, the government allowed the Ministry of Education to fill the gap by hiring Ph.D. graduates in physics and engineering. Those, like me, who do not have a pedagogy certificate (and Swedish-language certificate) can still

find teaching positions at international (English-speaking) high schools, although with fewer social benefits compared to the former group.

Work–Life Balance

The Swedes' strong work ethic does not translate into spending weekends in the office. You must rest and spend time with your family during the weekend to start the work week with renewed vigor and passion. When your child catches a cold and you have to stay with him or her, simply tell your boss that you are working from home. The working hours for research staff are flexible and based on trust and respect. You must deliver what you have promised, meet deadlines, and keep the quality high.

According to Swedish law, you are entitled to five weeks of paid vacation per year [6]. You are strongly encouraged by your boss to enjoy this vacation to remain healthy and productive. You can transfer a limited number of vacation days to the next year, but it is not recommended. During your vacation, you are fully insured, provided that you inform the head of your division before departure by filling out a vacation form.

Parents can enjoy a long maternity or paternity leave. They can even distribute that time throughout the year as they wish to ease the work–life balance.

During flu season, you are advised to stay at home and get well if you are sick; you should not come to work and spread the virus. There is a one-week vacation during mid-February that is called *sportslov* (*sport holiday*). During this week, families venture out and let their kids enjoy winter sports, such as skiing, ice skating, and ice fishing, among others.

If you have winter-induced tiredness (*tröt thet*) and seasonal depression, you are entitled to many professional services. The most important thing is that everyone understands you. Alternatively, you can travel to a place with more sunshine. Sweden's proximity to the most important destinations within Europe makes travel easy and affordable. For an international student or a postdoctoral fellow with a Schengen visa, going to conferences and meetings throughout Europe is easy, and it strengthens your CV. If you happen to be an international student in Canada waiting for a clearance check of your U.S. visa application, you'll know what I mean.

Social System and Services

As a postdoctoral researcher, I am paying more or less the same amount of tax I used to pay in Canada. However, it is the Swedish Tax Agency (Skatteverket) who fills out your tax return—not you. The Skatteverket sends you the filled-out form a few weeks before the tax declaration deadline. If there is any difference or change, there are sections for making amendments; otherwise, sign the already filled-out form, and drop it in the mailboxes in front of every social service building. This is one of the moments when you feel that you have been taxed fairly, as the huge and unnecessary stress of filling out the tax return form (and the time it wastes) do not exist. Since it is the university (or in general, your employer) who informs the tax agency about your salary, benefits, deductions, and so on, there is no need to supply the tax agency with loads of paper.

Government public services in Sweden provide assistance in many different languages. This is extremely helpful for recently landed immigrants and those, like me, who work in Sweden temporarily. When I received my SIN card (called *Swedish ID* here), it was accompanied by "Welcome to Sweden" letters in three languages—Swedish; English; and my mother tongue, Persian—explaining to me the next steps. Even documents such as driver's test booklets are published by the Swedish government in many languages, and they are available to be borrowed from the public libraries.

I also have the option of receiving an English version of my tax return assessment in case I want to submit it to the Canada Revenue Agency. All these of services and documents sent to you are free of charge.

Regarding health care, I am impressed by the fast and patient-friendly technology. A nurse plugs your blood or urine samples into a tabletop analyzer before your eyes. You observe the results being printed, and the doctor looks at them and reports to you right on the spot. In special cases, there may be a delay of a week or so to receive a report back from a hospital laboratory.

If you intend to move to a new place, all you need to do is file a moving report form on the website of the Skatteverket. After 24 hours, your new address is known to every public service agency in Sweden, including health centers; your bank; your credit card provider; and TV, Internet, and phone service providers,

among others. Most movers in Sweden, both international and intranational (intercity, intracity) are very professional, fast, efficient, and fair in terms of pricing.

In addition, education in Sweden is free. Swedish citizens can send their children to very good universities without paying any tuition.

Regarding public transportation, I must say it is transportation technology at its best, although they don't have Japanese Shinkansen (bullet trains) yet. However, each and every corner of the Gothenburg area—even rural portions—has access to public buses that run frequently, regularly, and precisely. They are mostly fueled by methane gas extracted from human waste and compost. Express trains made by Sweden (e.g., X2000) take you from Gothenburg to Stockholm in three hours, a trip that usually takes six hours by car. Electric buses made by Chalmers University of Technology and Volvo are available every 10–15 minutes to take you back and forth between the Johanneberg and Lindholmen campuses, which are separated by the Göta River. Recently, a driverless bus has started to operate within the main campus.

People

In sharp contrast to the stereotypical remarks that I used to hear before coming to this country, Swedes are not reluctant to talk to foreigners. Darkness and the cold winters have nothing to do with their social attitudes. From the Lucia festival in December until Midsummer Day in June, there are many events that symbolize the happiness, love, and care of Swedes for family, friends, humanity, and nature.

I will say that Swedes are more formal, shyer, and less talkative than I am, so I initiate conversations and often find myself in a friendly and instructive chat. There is a considerable chance the very nice senior person I am talking to was once an engineer working in Ontario! Or they might have visited Persepolis in my original country, Iran, a few times.

Swedes are language aware, if not linguists. Everyone speaks English, and most know a few other languages as well, even Japanese! This is very helpful if you visit Sweden as a tourist or for a short visit. On the negative side, this reduces your incentive to become well versed in speaking Swedish.

In general, I find Swedes very knowledgeable and studious about different cultures and languages in the world. There are simple reasons for that—they read a lot, travel extensively, and host people from many cultures in their land as immigrants. Even schools educate children about the different cultures, languages, and traditions that exist in Sweden, especially those of immigrants.

The people of Sweden are fans of science. Isn't that because they live in Alfred Nobel's land? Every year, the National Swedish TV (SVT) educates viewers by broadcasting the Nobel Prize ceremony from beginning to end. On a mid-December Sunday, sit before the TV and watch the Nobel Prize ceremony and its sparkling gala dinner all day long. Let SVT reporters educate and amaze you about gravitational waves, topological materials, conjugate polymers, and so on. More proof of what I say is this: In every newsstand in Sweden, you can see newspapers, such as *NyTeknik* (*New Engineering*) and *Dagens Industri* (*Industry Today*), and magazines, including *Teknik Historia* (*History of Engineering*), *Språk* (*Language*), *AXESS*, *Företagshistoia* (*Business History*), and so on. In this era of having access to virtually everything online, being bombarded by so much bad news, and getting distracted by social media, there are still people who buy and read publications with in-depth reporting. I am also very fascinated by the quality of the television programs being broadcast, such as the material on the SVT channels, AXESS TV, and Kunskapskanalen (Science Channel)—all without commercial advertisements.

The Job Market

As I do not yet have direct experience with any Swedish industry, let me relate what others have found. In our department, I witnessed three Ph.D. students graduate during the past two years. One of them did her Ph.D. degree in the molecular dynamics study of nanomaterials and ended up being an antenna designer for a telecommunications company. Two of them did theoretical studies of heat and electron transport and quantum nanomechanical effects in condensed matter. Upon leaving Chalmers, one of them was hired as a simulation engineer for electric cars and the other as a designer in Saab's Aircraft division. It seems that industries here appreciate the importance of fundamental science and try to absorb people with broad visions for their future developments. A problem solver trained in quantum mechanics seems more appealing than a master of this or that microcontroller or programming language.

Criticism

I am not at all successful in hiding my enthusiasm about this beautiful, advanced, independent, and strong country. Therefore, balancing up my accounts by noting a few areas for improvement seems to be in order. First, the public health system is one concern. Notwithstanding my earlier praise for its use of technology, doctors seem very reluctant to take your symptoms seriously and refer you to a specialist for a more thorough test. During August, all doctors are away for vacation, so try not to be sick that month!

Finding an apartment or townhouse to rent is very difficult here in Gothenburg. Before moving to Sweden, your employer helps you by hiring agents to find a place for rent. To find a new home, however, you must do a lot of searching, calling, emailing, and promoting yourself as a good tenant, highlighting your Swedish references. In some cases, you are interviewed by the landlord. Usually, your manager and the nice staff at the university do their best to help you, inform you of any available housing options, and even assist you with regard to references and recommendations. Prices—as you may have guessed—are higher here than in Canada. Rent is almost twice what I used to pay in Ontario. Everything else is 1.5 times more expensive than its Canadian counterpart, even for something of the same brand or quality. This can

be generalized to other major cities of Europe, though.

Dark Swedish winters make it hard to keep one's spirits up. However, having social gatherings with colleagues and friends; restaurants and bars that stay open until late at night; charming coffee shops with nice furniture; real candles and vases of daily-delivered flowers on every table; bountiful quantities of fish, shrimp, and beer; *semla* (a cream puff pastry with almond paste) and *saffron bulle* (saffron bun) during winter; and, importantly, lack of wind chill and freezing rain make the winters bearable. Spending a vacation in sunny Southeast Asia is another option, especially if you are asked by your boss to use your vacation days before the year ends.

Coda

The friendliness of the faculty, staff, and colleagues here at Chalmers has made my stay an unforgettable memory—a precious lesson and experience that I look forward to sharing wherever I go. I strongly suggest that graduate students in Canada should also visit this endless source of learning and explore Sweden as a part of their education. Come here for an internship, Ph.D. study, or postdoctoral research.

I encourage engineering faculty members in Canada to send their graduate students here for an internship. Luckily, there are good examples of such student exchange programs between the University of Waterloo, Chalmers University of Technology, and Lund University. Even teaching experiences (course contents, choice of textbooks, and teaching techniques) are something that could be exchanged between Swedish and Canadian professors. Translating teaching resources from Swedish to English or vice versa is something that teachers and students of both countries can benefit from.

Faculty members can spend their sabbatical leave here. Be ambassadors of Canadian culture, literature, science, and technology. This is what the Japanese do for Japanese science and literature, right next door to the Royal Swedish Academy at Stockholm [7]. Let's not lag behind them.

There are many similarities between Canada and Sweden: they are two strong, independent, and industrious countries that work hard to invest in fundamental sciences and engineering research for the well-being of their own people. Both countries strive to isolate and protect their people from the ups and downs of the global economy and political chaos around the world. Both countries share a long history of being promoters of peace and multiculturalism, and they share the same concerns regarding the well-being of the Arctic.

I am very happy that I refused to listen to the common advice of "Everyone goes to Silicon Valley" after my Ph.D. years. Entering the Nobel Museum, seeing the hanging portrait of Svante Arrhenius, and remembering the very first chemistry book my father bought for me brings a smile to my face, warms my heart, and tells me that coming to Sweden was the best choice I've ever made. ■

Acknowledgments

I would like to sincerely thank my mentors, colleagues, and friends at Chalmers University of Technology for their hospitality, support, advice, and help whenever needed. I would also like to tender my gratitude to the past editor-in-chief, Mr. Bruce Van-Lane, for giving me such a unique opportunity to share my observations with colleagues and friends in Canada. Last but not least, the art director, Mr. Pal Singh, has done a wonderful job of creating beautiful graphics that skillfully illustrate my story. Many thanks for that.

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About the Author

Daryoush Shiri received his Ph.D. degree in electrical and computer engineering in 2013 from the University of Waterloo, Canada. Prior to this, he worked in a few start-up companies as a radio-frequency/analog CMOS design engineer and team leader. His thesis was devoted to the computational study of electron transport in silicon nanowires. As a postdoctoral fellow at the Institute for Quantum Computing, Waterloo (2013–2015), he collaborated in developing a scalable package for quantum-computing circuits. He came to Sweden in 2016 as a postdoctoral fellow at the Department of Physics, Chalmers University of Technology, to work on heat transport in 2D materials. Currently, he is a researcher at Quantum Technology Laboratory in the same university, working on the simulation of superconducting microwave circuits for quantum computing. He co-supervised several Ph.D. and master's degree students during these years. He loves teaching and always quotes John Archibald Wheeler: "If you would learn, teach." In his free time, he enjoys cycling, cooking, translating, and reading historical/comparative linguistics. He is a Member of the IEEE, APS, and German Physical Society.

N.Ed.: Dr. Daryoush Shiri is also the translator of "Letters from Canada," published in our Winter 2017 issue. Written by two German scientists posted to our country in the early 1990s, that piece explores Canada's technological achievements from an outsider's perspective and identifies challenges in Canada's R&D landscape at that time. *IEEE Canadian Review* welcomes proposals from our readers reflecting on their experiences working abroad, either past or present; contact icr@ieee.ca.

Dr. Shiri's acknowledgements include appreciation for the efforts of the magazine's art director. Beginning with the summer 2013 issue, Pal Singh's inspired page layouts and original illustrations have elevated this publication's presentation to an unprecedented level. This article is now published in a redesigned format. Readers interested in receiving a copy of the original article (inclusive of Pal Singh's artwork) may contact icr@ieee.ca.

How and Why I Volunteered for the IEEE

Murray MacDonald

Murray MacDonald
Vice-Chair of the London Section
Region 7 Teacher In-Service Committee Chair
murraymacdonald@ieee.org

My first involvement with the IEEE was probably very typical—as a Student Member. I served as a Student Branch treasurer, took part in some fun events, and attended visiting lectures linked to the IEEE. Many of us joined for technical reasons as, in the era before the Internet, the IEEE was seen as a fount of up-to-date technical information. I still recall a visit from the renowned Bill McMurray from GE Labs in Schenectady, New York. After completing my graduate studies, I moved to work in the industry, and my active involvement with the IEEE virtually ceased.

A few years later, I had the good fortune to work for an IEEE-minded general manager, who encouraged me to become involved in the International Telecommunications Energy Conference (INTELEC). I coauthored my first paper for this conference in 1986. I have been actively involved with most of the INTELEC North American conferences ever since.

After becoming semiretired in 2009, I looked to the IEEE for an opportunity to give back. The IEEE's Teacher In-Service Program (TISP) was just getting rolled out in Canada, and that matched my interest. I continue to have a fulfilling involvement with the TISP London Section. I am also the TISP Canada Committee chair for 2019.

Sensing my interest, Maike Luiken, the then London Section chair, convinced me to take on the Section secretary role.

Dr. William "Bill" McMurray (1929–2006) was a power electronics legend. From 1953 to 1988, he worked at GE. He was the authority on thyristor commutation circuits. He wrote the book Theory and Design of Cycloconverters, *and he contributed to the book* Principles of the Inverter Circuits *by Bedford and Hoft (1964), which was the bible for power electronics in those days. Bill was the inventor of the McMurray inverter and McMurray–Bedford inverter. For more information, see* IEEE Industrial Electronics Magazine, *Spring 2007, page 45.*

This was followed by rewarding opportunities to serve as the vice-chair and then the chair. In 2011, I had the honor to receive the MGA Outstanding Small Section Award. I am particularly proud of my role in the Women in Engineering and Young Professionals affinity groups in London. I was also tapped at the Region 7 level to become the Central Area chair. Over the years, I have helped a number of colleagues, particularly from the industry, to elevate their membership—having received similar support myself.

Along the way, I helped organize several IEEE conferences: EPEC 2012, EPEC 2015, IHTC 2017, and EPEC 2018. I am always learning something new about conferences.

I continue to be an IEEE volunteer to give back to the professional community and to the society. I find these opportunities very fulfilling. I always find that the IEEE has a wealth of current knowledge in my various technical fields of interest. ■

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The 33rd Canadian Conference on Electrical and Computer Engineering (CCECE 2020) will be held in London, Ontario, Canada on April 26-29, 2020 at the London Convention Centre. CCECE is the flagship conference where researchers, students, and professionals in the area of Electrical and Computer Engineering meet annually in a Canadian city to get up to speed with the latest developments, foray into new fields and emerging topics, network with colleagues to strengthen partnerships and foster new collaborations.

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Triumph of a Dream

The Canadian research centre, TRIUMF, is now 50+ years old and seeks new challenges in dealing with big data

An English translation by
Daryoush Shiri
Chalmers University of Technology, Sweden

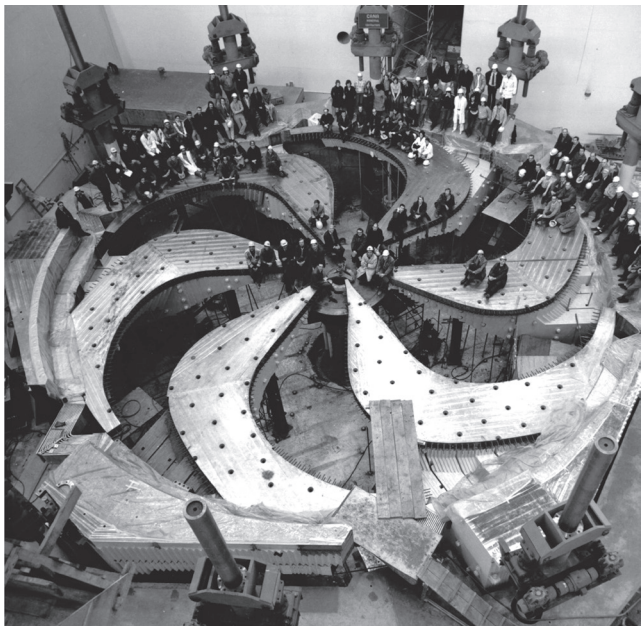
K. Sonnabend, "Triumpf einer Vision," *Physik J.*, vol. 17, no. 12, 2018

N.Ed.: The contributions of the Tri-university Meson Facility (TRIUMF) to many branches of science have been recognized through an IEEE Milestone. Dedicated in December 2010, the Milestone plaque notes that the first 500-MeV proton beam was extracted from the facility in November 1974. Revolutionary computer-related technologies were needed to achieve its design. The IEEE Vancouver Section prepared the Milestone nomination, led by Prof. Dave Michelson of the University of British Columbia. See https://ethw.org/Milestones:First_500_MeV_Proton_Beam_from_the_TRIUMF_Cyclotron,_1974.

This article was prepared in early 2019. Readers are encouraged to explore the latest information using the links provided.

The campus of the University of British Columbia is located on a picturesque peninsula in the western part of Vancouver. About 50 years ago, three universities had a dream here: Simon Fraser University, the University of British Columbia, and the University of Victoria joined in 1968 to build the world's largest cyclotron accelerator. The goal of the facility, doing research on mesons, is still reflected in the name of the centre, TRIUMF, which is an acronym for Tri-university Meson Facility (www.triumf.ca). Today, 20 universities are participating as the members or associated partners of TRIUMF, and research is ongoing based on this goal, which includes investigating nuclear and particle physics, nuclear medicine, and materials science and biosciences.

The heart of the facility is a 520-MeV cyclotron. The accelerator, still the largest of its kind in the world. with an 18-m-diameter magnet, makes four beam lines of protons available at the same time. Using this, experiments with different secondary radiations, such as neutrons, pions, and muons, take place in parallel. Especially using the ISOL method developed at the end of the 1980s, many radioactive isotopes are produced. Using these, many nuclear reactions can be investigated that play important roles in the synthesis of elements and formation of stars. In addition, the decaying characteristics of unstable isotopes offer the possibility of performing high-precision tests for the standard model [of particle physics].



Members of the TRIUMF community pose on the lower six sectors of the cyclotron magnet during construction (January 1972). (Source: TRIUMF.)

Since its beginning, German universities and research institutes kept a close relationship with TRIUMF, particularly to experiment at the world-renowned unique facilities as external users and benefit from the developments there. At the same time, the research centre attracts high-calibre talent from Germany to the west coast of Canada. For example, Jens Dilling, who has worked there for 17 years as the associate director of the institute and leads the division of natural sciences, says, "Doing research with top-notch scientists from all over the world brings new inspiration every day here." He became familiar with the experimental facilities of TRIUMF during his thesis research, and, after completing his postdoctoral in Heidelberg, he moved to Canada permanently.

> **"Doing research with top-notch scientists from all over the world brings new inspiration every day here."**

The most recent example of German–Canadian collaboration is the agreement to process a large amount of data (big data) using machine learning as well as perform research on future quantum computers. On the German side, the Jülich Research Centre and DESY are collaborating as members of Helmholtz Association; in addition to TRIUMF, Canadian companies, such as D-Wave Systems Inc. and 1Qbit,

Different events were held through the year to celebrate the laboratory's birthday.

work together with TRIUMF Innovations. "An early start to researching the scientific applications of this field establishes totally new pillars for TRIUMF," says Dilling. "That helps us to push the forefronts of science for another 50 years together with Canadian and international partners" (see "Translator's Note").

Different events were held through the year to celebrate the laboratory's birthday (www.triumf50.com). Anja Karliczek, federal research minister [of Germany], found the jubilee a reason to visit TRIUMF to learn about Canadian–German collaborations as part of her first non-European visit. Canadian Prime Minister Justin Trudeau visited the research institute at the beginning of November [2018] and pledged a gift: to finance founding the Institute for Advanced Isotopes, where the production of future radiopharmaceuticals for cancer therapy and urgent production of the Tc-99m isotope for medical imaging will take place.

Trudeau was delighted to receive a special present: the TRIUMF director, Jonathan A. Bagger, presented him with a framed picture showing Trudeau's father, Pierre, during the opening ceremony of the cyclotron in February 1976. During the ceremony, Pierre Trudeau, the then Canadian prime minister, said these frequently quoted words: "I don't know really what a Cyclotron is, but I am very glad that there is one in Canada." ■

Prime Minister Justin Trudeau pays TRIUMF research institute a visit in celebration of its 50th birthday (1 November 2018). (Source: TRIUMF/CC BY-NC-SA 2.0.)

Translator's note

An example of these partnerships is the ALPHA-g detector, built by TRIUMF and shipped to CERN in Switzerland. This sensitive detector is built to see if antimatter (antihydrogen atom) defies gravity and moves up instead of falling when released from a magnetic trap. The ALPHA team tries to shed light on the process through which all of the antimatter produced from the Big Bang was eliminated from the universe, such that all that is left for us to see is matter. It is believed that equal amounts of matter and antimatter were initially created.

For a more detailed account of this intriguing experiment, see "New ALPHA-g Detector Poised to Search for Signs of Antigravity," by Michelle Hampson in *IEEE Spectrum*. https://spectrum. ieee.org/tech-talk/aerospace/astrophysics/new-alphag-detector-poised-to-search-for-signs-of-antigravity. Since the publication of this article, the ALPHA team successfully completed a test run before CERN shut down for maintenance and upgrading. The soonest the actual experiment will be conducted will be early to mid 2021, when antihydrogen will again be available. ■

Scientists at TRIUMF position the ALPHA-g detector in preparation for testing. The instrument was shipped in July 2018 to CERN, which is the only facility that can produce antimatter in sufficient quantity for the experiment. (Source: Stu Shepherd/TRIUMF.)

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The annual IEEE Canada Electrical Power and Energy Conference (EPEC 2020) will take place in Edmonton, Alberta, Canada from October 14-16, 2020. EPEC 2020 is a conference that provides an opportunity for experts from industry, academia, government sector and other interested organizations from Canada and abroad to present and discuss the latest developments in the electric power and energy systems: academic, industrial and government research and development, industrial and business trends and challenges, as well as regulatory and policy aspects. This includes debate on the potential impact of these developments on the society. The conference provides an international forum for the presentation of peer-reviewed papers and presentations on power and energy research and development, applications and their implementations.

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Canadian High School Students Participate in the European Space Agency's CanSat Competition

IEEE Canada Foundation supports science, technology, engineering, and mathematics initiative

BY **JOE MUISE**

In June 2019, a group of students from St. Thomas More Collegiate became the first Canadian team to take part in the European Space Agency's CanSat competition, thanks to an IEEE Canada Foundation Special Grant. The team of five students and their teacher, Joe Muise, travelled to Bologna, Italy, to compete against 19 other countries, demonstrating their technical skills in constructing a small probe that had to fit within the volume of a soda can (hence the name *CanSat).*

The probes were launched by rocket to an altitude of 1 km, and all teams had to collect and transmit temperature and pressure during descent. They also had to choose a secondary mission, and justify its scientific significance. The Burnaby students chose to create a topographical map from images collected during descent.

The students competed against teams from 18 other countries and were inspired to pursue careers in the science, technology, engineering, and mathematics fields. Two of the three graduating members of the team have already joined the CubeSat teams at their postsecondary institutions. The team is grateful for the support from IEEE Canada and the Canadian aerospace industry. ■

Joe Muise
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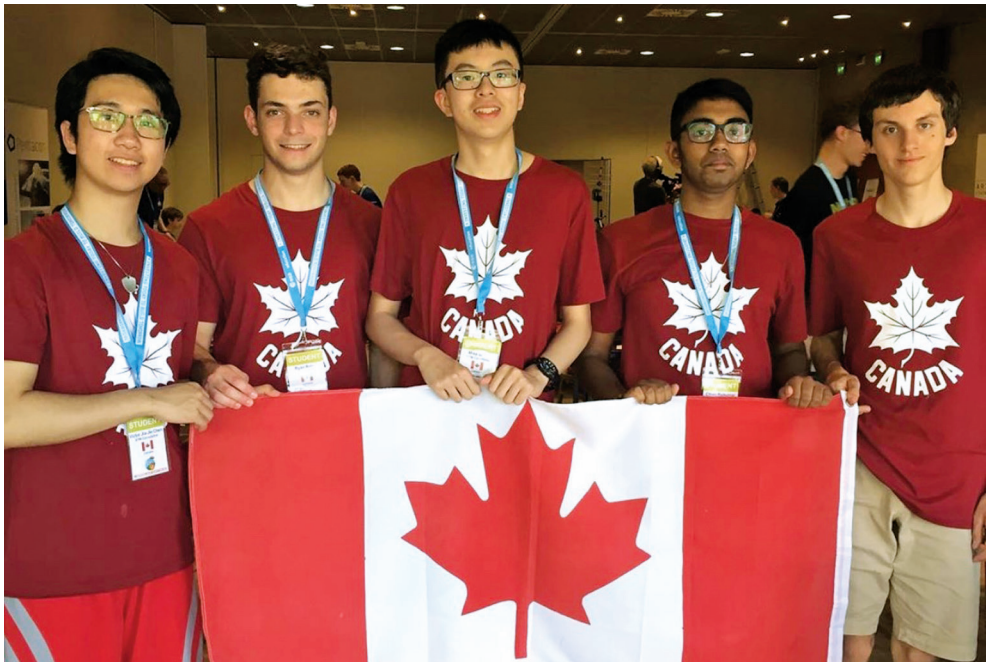


The members of the St. Thomas More Collegiate CanSat team (from left): Victor Chen, Ryan Rizzo, Mike Wang, Ethan Rajkumar, and Philip Stachura.

The team members answer questions from the CanSat competition's judges.

The IEEE Engineering Milestone "First Search and Rescue Using Satellite Technology, 1982"

By the IEEE Ottawa Section

The dedication ceremony to commemorate the "First Search and Rescue Using Satellite Location Technology, 1982" was held at the Canada Space and Aviation Museum in Ottawa on 9 September 2019. Bronze plaques, in both English and French, were unveiled by the chief guest, Dr. Robert Thirsk, and IEEE President José M.F. Moura in the presence of IEEE Canada President Dr. Maike Luiken. The event was attended by more than 50 guests, including representatives from the National Search and Rescue Secretariat, Canadian Armed Forces, National Research Council, and Department of National Defense.

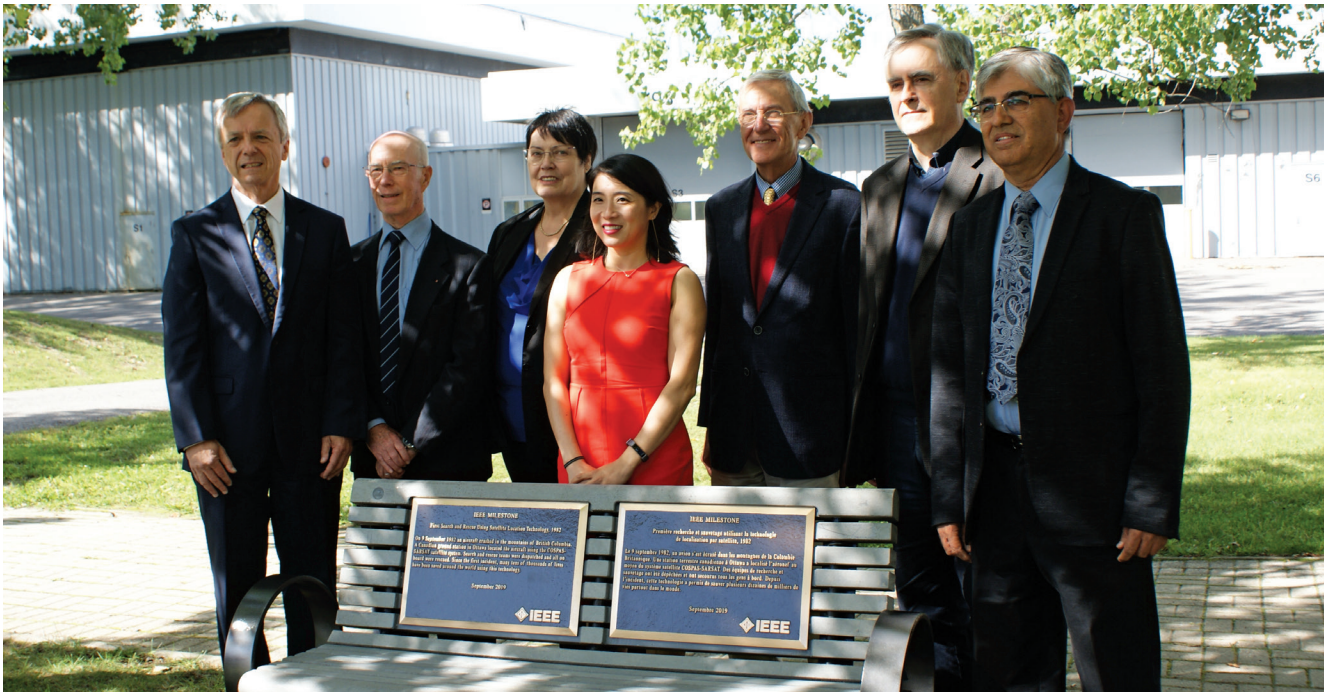
The citation on the plaque is as follows:

First Search and Rescue Using Satellite Location Technology, 1982

On 9 September 1982 an aircraft crashed in the mountains of British Columbia. A Canadian ground station in Ottawa located the aircraft using the COSPAS-SARSAT satellite system. Search and rescue teams were dispatched and all on board were rescued. Since the first incident, many tens of thousands of lives have been saved around the world using this technology. ■

Première recherche et sauvetage utilisant la technologie de localisation par satellite, 1982

Le 9 septembre 1982, un avion s'est écrasé dans les montagnes de la Colombie Britannique. Une station terrestre canadienne à Ottawa a localisé l'aéronef au moyen du système satellite COSPAS-SARSAT. Des équipes de recherche et sauvetage ont été dépêchées et ont secourus tous les gens à bord. Depuis l'incident, cette technologie a permis de sauver plusieurs dizaines de milliers de vies partout dans le monde. ■



(From left): Dr. Robert Thirsk, Dr. Michael A. Stott, Dr. Maike Luiken, Dr. Winnie N. Ye, Dr. José Moura, Dr. Branislav Djokic, and Mr. Ajit Pardasani at the dedication ceremony.

The designs of the space stations Salyut, Skylab, Mir, the International Space Station, and Tiangong-1 shared key considerations to survive the launch and keep crews alive with sophisticated life support systems. However, we seldom consider what happens when those massive structures re-enter the atmosphere and plummet back into our pale blue dot. In this column, we looked back through some notable spacecraft re-entries, discuss their impacts and risks, and, ultimately, consider a different future where we can prolong or re-use spacecraft.

Ad adstra,
Dario Schor; schor@ieee.org

BACK IN 2018, in anticipation of the uncontrolled orbital re-entry of the first Chinese space station, *Tiangong-1*, the Argentinean space agency, la Comisión Nacional de Actividades Espaciales, published warnings in local papers advising citizens to stay away from windows during the six potential re-entry passes over its territory [1]. The articles included maps showing the trajectory of each pass as well as the time and duration so that people could be prepared. Furthermore, they warned individuals that if they did encounter a piece of debris, they should alert the authorities and stay at least 20 m away from it at all times in case the objects had sharp edges or toxic chemicals such as hydrazine, which is often used for propulsion systems.

Tiangong-1 (Figure 1) was launched in September 2011 and visited by two groups of taikonauts before it was put into sleep mode. The engineers intended to collect data for some period before decommissioning the station through a controlled re-entry. However, things did not go as planned, and, on 16 March 2016, the station ceased functioning at an altitude of 349 km, with a daily decay rate of approximately 160 m/d. The Chinese government issued a warning through the United Nations and stated its intentions to monitor the re-entry through the Inter-Agency Space Debris Coordination Committee [2]. Many tracking stations monitored the orbital decay and attempted to predict when and where the station would plunge to the surface (Figure 2).

Since two-thirds of Earth is covered by water, the chances of any piece of space debris landing over a populated area are very slim. In fact, the Aerospace Corporation estimates the probability of being hit by orbital debris that reenters the atmosphere as one in a trillion [3]. However, despite those statistics, the Argentinean government was not taking any chances. The country learned its lesson after fragments of debris from the Russian *Salyut-7* station (*Mir*'s predecessor) overshot its entry point and were scattered over the town of Capitán Bermúdez.

Whether we want to accept it or not, pieces of human-made objects in low Earth orbit (LEO) reenter the atmosphere on a regular basis. Canadian artist Brandon Vickerd captured the "modern-day Icarus" nature of these technological wonders through his powerful and dramatic sculptures displaying space objects crashed on top of cars or on the ground (Figure 3). For us engineers, these thought-provoking art pieces remind us to consider the entire lifecycle of a space mission, from launch until it is fully decommissioned. In actuality, most components from small satellites burn up due to the heat generated by the interaction between the space objects travelling at 7 km/s in a vacuum and particles encountered as they enter Earth's atmosphere. Only the components designed to withstand high temperatures can pose a threat to both people and property during re-entry.

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This is not a new concept. The first account of space debris landing in

Figure 1: China's *Tiangong-1* space station. The main cylindrical body was 10.4 m long and had a 3.35-m diameter, comparable in volume to a school bus. (Source: China Manned Space Engineering Office.)

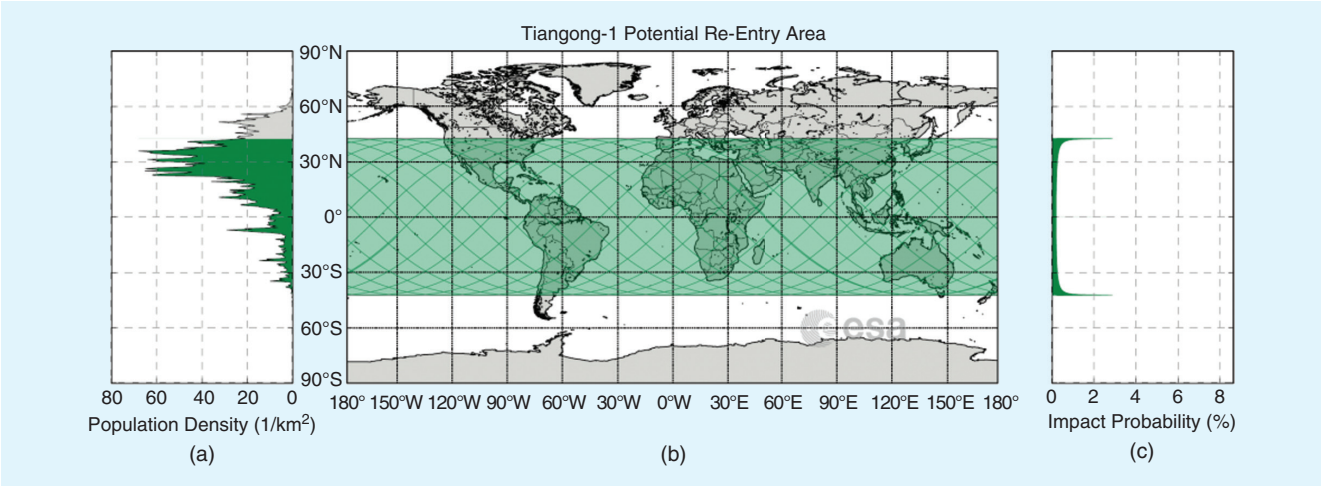

Figure 2: The *Tiangong-1* re-entry predictions, showing that, despite uncontrolled re-entry, there is a very low chance of debris landing in a populated area when considering the orbit and the distribution of people on our planet. (a) The population density by latitude. (b) The ground track for the last 24 hours before re-entry. (c) The impact probability by latitude. (Source: European Space Agency.)

populated areas dates back to the night of 6 September 1962, when a circular piece of metal crashed on the streets of Manitowoc, Wisconsin. Originally kicked off the curve by police officers patrolling the streets who thought it was just a scrap that fell off a garbage wagon, people later realized it was a piece of the Soviet *Sputnik-4* spacecraft. The town commemorated this illustrious event with a plaque on the street [4], a duplicate at the local museum, and an annual Sputnikfest street party. Another notable example involves the large pressurized tanks from the first U.S. space station, *Skylab* (Figure 4), which fell over the town of Esperance in Australia in 1979. Although they did not cause any damage, the town issued a gag $400 littering ticket to NASA, which was paid in 2003 through a collection organized by disc jockey Scott Barley from a radio station in California.

Canada's geographical position and wide spread are considered both advantageous and disadvantageous with respect to its space assets. Many LEO spacecrafts are launched with low inclinations—meaning that the satellite does not cover areas at high latitudes—so our fellow Canadians in northern communities cannot reliably depend on satellite communications or navigation like those living closer to the 49th parallel. Near-polar inclinations are used by a handful of nations with shared interest in monitoring the Arctic and by Earth observation missions flying in a sun-synchronous orbit. Still, there have been cases of debris landing in Canada, with the two most notable examples being the Soviet reconnaissance satellite *Kosmos-954* (1978) and NASA's *Upper Atmosphere Research Satellite* (2011). These types of events scatter debris over large areas spanning hundreds of kilometers and cost millions to clean up.

Photo: Brandon Vickerd

Figure 3: An artist's rendition of hypothetical satellite re-entry if no parts were burned up in the atmosphere: *Sputnik Return 2* by Brandon Vickerd, 2015; 3.2 × 3 × 2.4 m; stainless steel, Acura sedan.

With all of these examples of uncontrolled re-entries over populated areas, it is a wonder that there is only a single case of a person reported to have been struck by space debris.

With all of these examples of uncontrolled re-entries over populated areas, it is a wonder that there is only a single case of a person reported to have been struck by space debris. That unfortunate individual was Ms. Lottie Williams, who was hit by a small piece of a *Delta II* rocket fuel tank while walking through a park in Tulsa, Oklahoma, on 22 January 1997 [5]. As

Figure 4: The U.S. *Skylab* space station. The main cylindrical body was 25.1 m with a 6.6-m diameter—a volume an order of magnitude larger than that of *Tiangong-1*. During the 1973 launch, a micrometeoroid hit the station, jamming one of the main solar panels before it could be deployed. The crew was able to recover and use the station as shown until its decommissioning in 1979. (Source: NASA.)

luck would have it, the object glanced her head, and she did not sustain any serious injuries from the incidence.

Obviously, uncontrolled re-entries are not anyone's first choice. Large missions in LEO budget their propellant to ensure they have enough for a deorbiting maneuver aimed at the spacecraft graveyard known as *Point Nemo* in the South Pacific. Named after Jules Verne's Captain Nemo from *Twenty Thousand Leagues Under the Sea*, this point is farthest away from any landmass. Its precise location was calculated to be at 48.88° S and 123.39° W, making it more than 2,500 km away from the three closest coasts of Ducie Island, Motu Nui (part of the Easter Island group), and Maher Island. As an added bonus, this area is not biologically diverse, so the debris has a very limited impact on the environment compared to other potential oceanic targets.

To date, more than 300 spacecrafts have plummeted to the ocean floor at Point Nemo. The largest object to take the "ice bucket challenge" was the *Mir* space station in 2001, weighing 120 tons. (Not all of it survived re-entry.) Notably, Taco Bell, the fast food chain, used the re-entry as part of a publicity stunt, advertising that if *Mir* landed within a 40-ft × 40-ft bullseye labeled "Free Taco Here," the company would offer coupons for free tacos to everyone in the United States. Although this is unrealistic, given that space debris is often scattered over a large area and it is impossible to pinpoint the exact location, it did make national news. Even though there is no fixed date, at some point in the next decade, the record-setting MIR deorbiting maneuver will be surpassed by the *International Space Station* as it is decommissioned after many years of service.

Better approaches are being tested and investigated for reusable booster rockets, such as those demonstrated by Space X, and serviceable spacecraft that can prolong their operation for years to come.

Ultimately, neither controller or uncontrolled re-entries are the ideal solution due to the risks for humans and waste of materials. Better approaches are being tested and investigated for reusable booster rockets, such as those demonstrated by Space X, and serviceable spacecraft that can prolong their operation for years to come. Definitely an exciting challenge for engineers. ■

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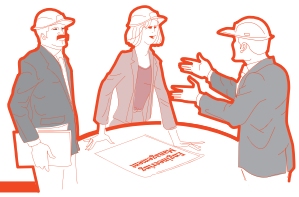
About the Author

Dario Schor is currently a software engineer at Magellan Aerospace while pursuing a space studies Ph.D. at the University of North Dakota. He obtained his B.Sc. and M.Sc. degrees in computer engineering from the University of Manitoba in 2008 and 2013, respectively, before attending the 2013 Space Studies Program from the International Space University in Strasbourg, France. Dario has served in various roles within IEEE Canada and the Winnipeg Section. He can be reached by email at schor@ieee.org.

What's New in the Literature?



by Terrance Malkinson

Based on three-year revenue growth, the October 2019 issue of *The Globe and Mail* reports on Canada's top 400 growing companies [pp. 37–77; www.theglobeandmail.com]. Leaders include FleetOptics Inc., Exzell Pharma Inc., and MissFresh Inc. Profiles from a selection of these 400 boldest Canadian businesses are provided. The April 2019 issue of *Financial Post Magazine* [pp. 10–19; www.financialpost.com] highlights the most innovative companies in Canada as part of its continuing "Innovation Nation" series. The 20th annual edition of "Canada's Top 100 Employers," copublished by *The Globe and Mail* and Mediacorp, provides many useful insights on Canadian businesses that have built exceptional organizations through best practices coupled with progressive and innovative programs that push the boundaries to make the workplace better for their employees. Reader-friendly profiles of each of the winners describe the critical factors that contributed to their success. The Summer 2019 issue of *Corporate Knights* [www.corporateknights.com] discusses the best 50 Canadian organizations that are exemplars of clean capitalism. Clean capitalism refers to an economic system in which prices incorporate social, economic, and ecological benefits and costs. Leaders include The Co-operators, Hydro-Québec, Algonquin Power & Utilities, and Teck Resources.

In Calgary, a village of 15, 280-ft² homes arranged around the Canadian flag was recently opened and is now home to military veterans who have had difficulty adapting to civilian life.

A diversification strategy is critical for success in our rapidly changing business environment. Linamar Corporation [www.linamar.com], Canada's second-largest auto parts supplier, earns the majority of its revenue by selling components for the global vehicle market but understands the value of continually diversifying itself into complementary business sectors that provide sustainable growth. This Guelph, Ontario, auto parts maker will start manufacturing robotic medical devices in its new innovation hub as part of its diversification strategy. Recently, it announced a $5 million investment in Synaptive Medical Inc. [www.synaptivemedical.com] and will manufacture two of the Toronto-based medical technologies company's patented surgical and imaging devices.

As reported in an article in the 11 November 2019 issue of *The Globe and Mail* [p. A-11], Toronto surgeons have performed their first robot-assisted brain surgery by testing a system that they believe will allow them, in the near future, to operate remotely on stroke and aneurysm patients. The surgical team at the University Health Network [www.uhn.ca] successfully placed a stent and 14 coils deep inside the brain of a 64-year-old woman to treat an aneurysm. This proved the viability of the system to precisely repair the delicate vessels of the brain and opens the door to remote procedures (possibly within a year) in communities where they do not have the personnel to perform these complex procedures. The Bank of Montreal is investing $5 million in a new artificial intelligence (AI) laboratory at the University of Toronto. Billed as a first-of-its-kind multidisciplinary hub, it will bring people together to study how AI can augment human creativity.

Recently, the Royal Swedish Academy of Sciences in Stockholm named Princeton University professor Dr. James Peebles from St. Boniface, Manitoba, as a recipient of the Nobel Prize in Physics for his many contributions to our understanding of the universe. Dr. Peebles' interest in science led him to the University of Manitoba, where his mentor steered him toward graduate studies at Princeton. Although based in the United States, fortunately, he maintains many ties with Canada, including the Perimeter Institute for Theoretical Physics [www.perimeterinstitute.ca], an independent research center in foundational theoretical physics located in Waterloo, Ontario.

In Calgary, a village of 15, 280-ft² homes arranged around the Canadian flag was recently opened and is now home to military veterans who have had difficulty adapting to civilian life. The 908 ATCO village [www.atco.com/en-ca/projects/homes-for-heroes.html] is spearheaded by the Homes for Heroes Foundation [www.homesforheroesfoundation.ca]. The foundation hopes to build similar villages across Canada, as the need is great: it is conservatively estimated that there are 3,500 homeless Canadian veterans. The goal of these transition housing projects is to bring an end to veterans' homelessness.

The cover story of the 18 November 2019 issue of *Bloomberg Businessweek* ["The Ultimate Backup Drive," pp. 48–53; www.bloomberg.com/businessweek] describes a cave deep beneath the surface of a Norwegian archipelago in the Arctic where some of the world's most important open source software code is archived on superdurable film, protecting it from destruction in the event of an apocalypse.

Canadian colleges are increasingly diversifying themselves to meet the needs of today's workplace. Many are focusing on fundamental applied research, turning knowledge into innovative solutions of considerable value to their industry partners. Government is responding by investing heavily in collegiate advanced technology research in Canada. A group of graduates from Red Deer College, Alberta, through its ASET-awarded capstone project, has created a prototype for a Wi-Fi drone that will provide connectivity for workers in remote areas or search and rescue teams. Hamilton's Mohawk College is currently engaged in 15 drone applied technology research projects.

Today, open offices and collaborative technologies are the norm. In the November-December 2019 *Harvard Business Review* article "The truth about open offices" [97(6):82–91; www.hbr.com], Ethan Vernstein and Ben Waber discuss the open office and provide evidence suggesting they are producing fewer meaningful interactions, not more, as predicted. The authors then discuss the strategies organizations can use that will help them equip employees with the spaces and technologies that best support their needs.

Two special editions of *Time* [www.time.com] discuss issues important to all members of the IEEE. The first of these, "The Science of Creativity," provides authoritative discussions on key factors related to the nature of human creativity. Reader-friendly information is provided in four categories: The Creative Animal, The Creative Mind, Creativity in Action, and Creativity at Any Age. Practical tips on how to unleash creativity in yourself, your children, and in the workplace are provided. The second special issue is "The Science of Stress: How to Manage It, Avoid It, and Put It to Use." The chapters include "Defining Stress," "Handling Stress," and "Stress in Society." It is clear that we are all vulnerable to stress and the serious illnesses that result from it. Information provided in the 20 easy-to-read articles contributes to our ability to be successful in a world filled with stressors.

In collaboration with the World Economic Forum [www.weforum.org], the December 2019 issue of *Scientific American* [321(6):26–37. www.ScientificAmerican.com] provides a special report on their selection of the top ten emerging technologies of 2019. The following are included: bioplastics for a circular economy; social robots; tiny lenses for miniature devices; disordered proteins as drug targets; smarter fertilizers that can reduce environmental contamination; collaborative telepresence; advanced food tracking and packaging; safer nuclear reactors; DNA data storage; and the utility-scale storage of renewable energy. A one-page profile of each of these technologies is provided. Further, the 2 December 2019 issue of *Time* [194(24–25):66–100; www.time.com/bestinventions2019] provides their selection of the 100 best inventions of 2019.

Economies are increasingly going digital, and Canada must make the transition from a natural resource-based economy that served us well in the past but will not sustain us in the future.

Harvard Business *Review* [97(6):46–54; www.hbr.org] profiles its "2019 Best Performing CEOs in the World" in its November-December 2019 issue. The leaders of this global list include Jensen Huang of Nvidia Corporation, Marc Benioff of Salesforce.com, Inc., Francois-Henri Pinault of Kering and Richard Templeton of Texas Instruments. The prevalence of information technology industry executives on this list is particularly noteworthy.

Recently, the World Economic Forum's (WEF's) Global Competitive Index was published and reveals that Canada has slipped two positions from the previous year's index, as was the case with the previous year [www.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf]. This is but one of many well-informed reports on the decline of creativity, innovation, and Canadian holistic competitiveness. There are many reasons for this, including the WEF's recommendation for improving the adoption of information and communication technology if Canada is to emerge as a technological leader. Economies are increasingly going digital, and Canada must make the transition from a natural resource-based economy that served us well in the past but will not sustain us in the future. Other solutions discussed by Pierre Lortie in his 28 September *The Globe and Mail* Opinion and Analysis article, "A Five-Step Plan to Increase Global Competitiveness in Canadian Businesses," include changing the tax regime that discriminates and penalizes innovation and high-growth companies, increasing the depth of Canada's public and private equity markets, making the acquisition and commercialization of intellectual property more attractive to Canadian companies, allowing Canadians the opportunity to personally benefit from their creativity and innovation, and fostering creative and innovative Canadian human talent.

The Canadian business community and governments at all levels must understand that we are on the cusp of another Industrial Revolution. Indeed, one of the most striking examples of this is in the automotive industry where a tectonic shift in vehicle technology is occurring globally, and indications, as described by Christopher Rauwald and David Welch and reported in the *Calgary Herald* on 9 December 2019, are that more than 80,000 positions will be eliminated as most, if not all, manufacturers are transitioning to the era of vehicular electrification. Recently, this was certainly evident when, after more than a century and 20 million automobiles built, the General Motors (GM) Co. plant in Oshawa, Ontario, manufactured its last vehicle Wednesday, 18 December, when a final pickup truck rolled off its assembly line. GM has been producing vehicles at the plant since 1918, making it the company's

oldest existing assembly plant. The shutdown of the Oshawa plant is part of a reorganization by GM to trim excess production as industry sales soften and resources shift toward electric and autonomous vehicles. The overall workforce reduction is 11,000 workers company wide.

The shutdown of the Oshawa plant is part of a reorganization by GM to trim excess production as industry sales soften and resources shift toward electric and autonomous vehicles.

The October 2019 special issue of *Bloomberg Businessweek* [www.bloomberg.com/businessweek] provides forecasts in its "The Year Ahead" column. Although focused on the United States, the numerous authoritative articles provide valuable insights into the future of Canada's industries. A more global perspective is provided in its November issue and categorizes the governance, trade, climate urbanization, finance, inclusion, and technology issues related to the shifting in wealth and power of the rising economies of Asia, the Middle East, Africa, and Latin America. As stated previously, the World Bank projects that, in 2020, emerging economies will grow at an average of 4.6% compared to just 1.5% for developed economies. ■

About the Author

Terrance Malkinson, the author of more than 500 peer- and editorial-reviewed publications, is now retired. However, in retirement, he vigorously continues research and journalism with an extensive portfolio of basic and applied research projects, journalism, philanthropy, and mentorship. His diverse career path includes 26 years in medical research as a founding member of the Faculty of Medicine at the University of Calgary, a three-year appointment as a manager with the General Electric Company, followed by a one-year applied research appointment with SAIT Polytechnic.

During his long career, he has advanced both basic and applied medical, health and wellness, scientific, and engineering knowledge. He has trained and mentored undergraduate, graduate, and postdoctoral students as well as staff in the business sector and government. He is a 45-year, long-term Member of the IEEE and, over the years, served in many IEEE governance and publication roles. His current research interest in health and wellness extends to being an accomplished multisports triathlete, including, among other achievements, the completion of 11 long-distance Ironman Triathlons.

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