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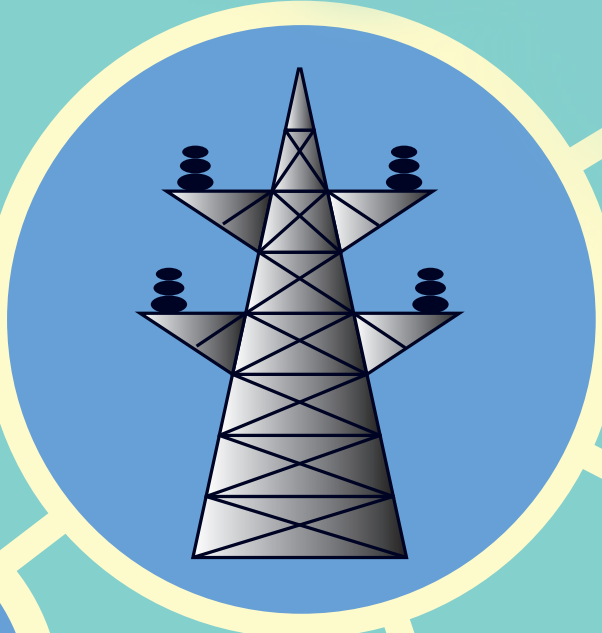
IEEE Canadian Review

La revue canadienne de l'IEEE

I.T. INFRASTRUCTURE *meets* ELECTRICAL INFRASTRUCTURE

- Communication for the Smart Grid
- Photovoltaic Overvoltage Prevention



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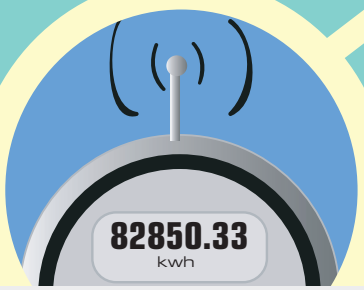

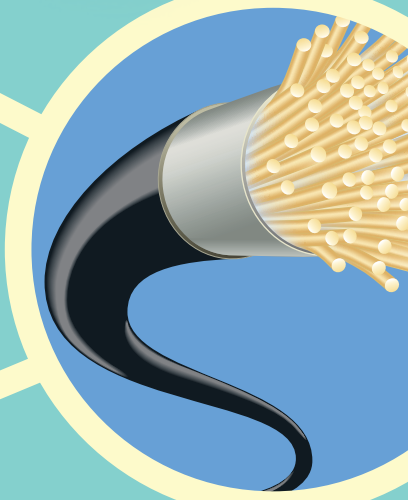

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(ii) Canadian members of the profession and community who are non-members of IEEE;

(iii) The associated Canadian academic (i.e., universities, colleges, secondary schools), government and business communities.

To ensure that the IEEE Canadian Review has the desired breadth and depth, editors are responsible for screening articles submitted according to the following general themes:

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Editorial / *Éditorial*

Amir Aghdam SMIEEE, Rédacteur en chef / Editor-in-Chief

This marks my first issue of *IEEE Canadian Review* as Editor-in-Chief and I couldn't be happier to find myself at the publication's helm. Over the past two years, I was honoured to be the magazine's Managing Editor, and lucky to have Eric Holdrinet as a great mentor. Eric has left our readership anticipating high standards from this magazine—a legacy that is sure to make my job quite the challenge! But quality is something that all IEEE Canada members have come to expect from this organization so I have to say *Merci beaucoup,* Eric, for your perfectionism!

Looking ahead, one of my goals in the coming months is to form an Advisory Committee. The main purpose will be to ensure that the range of content of the magazine continues to be aligned with the general interest of the membership, given the dynamic nature of engineering.

Turning towards the issue at hand, its backdrop is the recent nuclear power crisis in Japan. Quite fitting, then, that the vision of a greener tomorrow is the focus of our feature article on smart grids, which reviews communications requirements and challenges in this type of system. Shifting to related developments in Canada, another feature article explores the growing contribution of photovoltaics and how they can be integrated into the grid without creating overvoltage in distribution feeders.

While we strive towards a safer energy future, there are also hazards to be considered from the energy produced by the human body: sports injuries. Regular columnist Terrance Malkinson examines the important role IEEE can play in technological advancement to address the common injuries that plague both professional and amateur athletes. And, while few of us face on-the-job physical risk, our high-tech careers can carry their own kind of hazard—that of being sued by a disgruntled client!—as explained in a piece introducing a new IEEE Canada member benefit: liability insurance. These pages are also jam-packed with other reports and interesting news items, including a summary of the achievements of our 2011 IEEE Canada Awards recipients.

I do hope our efforts have produced an enjoyable read—after all, you are the judge here!—as we open up a new chapter for the *IEEE Canadian Review*. I wholeheartedly thank Concordia University and in particular the Faculty of Engineering and Computer Science, which has provided me with invaluable resources in connection to this magazine. Looking ahead to the Fall 2011 issue, I can tell you that we're planning a special issue on teaching innovation in electrical engineering. If you can contribute a related article of general interest, or have any suggestions or feedback, please contact me at aghdam@ieee.org.

Le présent numéro de *La revue canadienne de l'IEEE* est mon premier en tant que rédacteur en chef et je suis on ne peut plus ravi d'être à la barre de cette publication. Depuis deux ans, j'ai eu l'honneur d'être directeur de la rédaction du magazine, et la chance d'avoir pour mentor Eric Holdrinet. Grâce à lui, notre lectorat espère un contenu de haute qualité, ce qui ne me rendra sûrement pas la tâche facile! Cela dit, tous les membres de l'IEEE Canada s'attendent aujourd'hui à une telle qualité de leur organisme. Je remercie donc grandement Eric pour son perfectionnisme!

L'un de mes objectifs au cours des mois à venir sera de former un comité consultatif. Celui-ci s'assurera principalement que le contenu de la revue continue de refléter les intérêts généraux des membres, étant donné la nature dynamique du génie sous toutes ses formes.

Pour en revenir au présent numéro, après la récente crise nucléaire au Japon, il nous semblait approprié d'envisager des lendemains plus verts dans notre article de fond sur les réseaux électriques intelligents. Celui-ci aborde les exigences et les défis que présentent ces systèmes en matière de communications. Plus près de nous, un autre article de fond explore la contribution grandissante des photovoltaïques au Canada et la façon dont ils peuvent être intégrés au réseau électrique sans entraîner de surtension dans les câbles de distribution.

Tandis que nous travaillons à un avenir énergétique plus sûr, il nous faut également tenir compte des risques que comporte l'énergie produite par le corps humain, notamment chez les sportifs qui se blessent. Ainsi, notre chroniqueur Terrance Malkinson s'est penché sur le rôle important que peut jouer l'IEEE dans les avancées technologiques visant à parer aux blessures dont souffrent fréquemment les athlètes professionnels et amateurs. Et si la plupart d'entre nous ne courent aucun danger physique au travail, le secteur de la haute technologie peut tout de même comporter un risque particulier – celui d'être poursuivi par un client mécontent! –, comme l'explique un article sur un nouvel avantage offert aux membres : l'assurance responsabilité. Enfin, vous trouverez dans ces pages une foule d'autres reportages et nouvelles d'intérêt, y compris un aperçu des réalisations des lauréats de nos prix IEEE Canada 2011.

J'espère que vous apprécierez le fruit de nos efforts – puisqu'après tout, vous en êtes le juge! –, alors que *La revue canadienne de l'IEEE* entame un nouveau chapitre de son histoire. Je tiens à remercier l'Université Concordia et, en particulier, la Faculté de génie et d'informatique, qui m'a fourni des ressources inestimables pour le magazine. Nous préparons déjà notre édition de l'automne 2011, qui sera consacrée aux innovations dans l'enseignement en génie électrique. Si vous souhaitez soumettre un article d'intérêt général à ce sujet, ou si vous avez des suggestions ou des commentaires, veuillez communiquer avec moi à aghdam@ieee.org.

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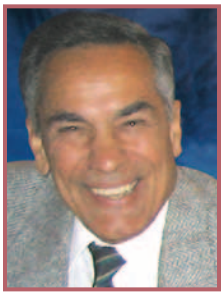

After five years of dedicated service Eric Holdrinet has stepped down as Editor-in-Chief of the *IEEE Canadian Review* (*CR*). Thank you, Eric, for the innumerable hours of volunteer service that you provided in sustaining the *CR* all these years. You introduced a number of innovative features that I am sure will continue to serve it well over a long time. Eric, I wish you all the best in the future and I hope that IEEE can count on your continued volunteer service to the IEEE.

With the closing of one chapter inevitably another chapter starts. While bidding a fond farewell to Eric, it is my pleasure to welcome Amir Aghdam as the new Editor-in-Chief of the *IEEE Canadian Review* with this edition. Amir has been very actively involved with the operation of the *CR* over the past two years. I am sure Amir has learnt the ropes well and that he will continue to maintain the standards set for the *CR* by his predecessors. Welcome and best wishes Amir.

IEEE Canada Board had its Spring 2011 meeting, April 29-May 1. In addition to a well organized training session on Friday for IEEE Canada volunteers arranged by Raed Abdullah, Secretary, IEEE Canada, with guests from IEEE headquarters in Piscataway, the IEEE Canada Board had an intensive whole day caucus meeting on Saturday and a formal Board meeting the following day. We were fortunate in having Keith Nelson, IEEE Director Division II and IEEE Vice-President MGA Howard Michel attend the meeting.

The three IEEE Canada 2012-2013 President-elect candidates made presentations to the Board. The election will be held in Fall 2011 and I urge all members to vote. In general, our election participation rate has been very low, in fact far lower than the low rate for the recently held federal election in Canada. If we cannot meet even that low rate, I hope that we can at least do far better than the last IEEE Canada election in which only about 14 % of the eligible voters cast their ballot. Be sure to visit our electronic newsletter site monthly for candidate statements and other election updates: http://www.ieee.ca/news/index.html

The Board also discussed the participation of the IEEE Sections in the upcoming IEEE Sections Congress scheduled for August 19-22, 2011 in San Francisco. In addition to the official delegate, each IEEE section in Canada will be able to send a second delegate. Sections Congress is an excellent opportunity to learn all that IEEE is about and also to make contacts with volunteers from all parts of the world.

In conclusion, I wish you all a very pleasant and enjoyable summer. Any comments and suggestions are welcome. Send them to me at maliko@ieee.org.

Om

Chers amis de l'IEEE Canada,

Après cinq années de service dévoué, Éric Holdrinet a quitté ses fonctions de rédacteur en chef de l*a Revue canadienne de l'IEEE* (*RC*). Merci Éric pour les heures innombrables de bénévolat consacrées à la *RC* toutes ces années. Vous avez mis en place plusieurs mesures innovatrices qui, j'en suis sûr, nous serviront pendant longtemps. Je vous souhaite, Éric, du succès pour vos futurs projets et j'espère que l'IEEE pourra encore compter sur vos services.

Avec la fin d'un chapitre, un autre débute inévitablement. Tout en offrant nos salutations à Éric, j'ai le plaisir d'accueillir Amir Aghdam, notre nouveau rédacteur en chef de *la Revue canadienne de l'IEEE* pour cette édition. Amir a été impliqué de près dans les opérations de la *RC* au cours des deux dernières années. Je suis sûr qu'il a beaucoup appris et qu'il continuera de maintenir les standards fixés par ses prédécesseurs pour la *RC*. Bienvenue Amir.

Le conseil d'administration de l'IEEE Canada s'est réuni au printemps 2011, du 29 avril au 1er mai. Outre un stage de formation pour les volontaires de l'IEEE Canada bien organisé par Raed Abdullah, secrétaire de l'IEEE Canada, avec des invités du QG de l'IEEE à Piscataway, le conseil d'administration de l'IEEE Canada a tenu une réunion de caucus intensive la journée entière de samedi et une réunion formelle le jour suivant. Nous avons eu le plaisir d'accueillir Keith Nelson, directeur Division II de l'IEEE II et Howard Michel, vice-président MGA de l'IEEE.

Les trois candidats au poste de président élu de l'IEEE Canada 2012-2013 ont fait des présentations au conseil. L'élection se tiendra à l'automne 2011 et j'invite tous les membres à voter. Habituellement notre taux de participation électorale est très bas, en fait bien inférieur au faible taux de participation pour l'élection fédérale qui s'est tenue récemment. Si nous ne pouvons même pas rencontrer ce faible taux, j'espère que nous pourrons au moins faire mieux que lors de la dernière élection de l'IEEE Canada pour laquelle seulement environ 14 % des électeurs éligibles ont voté. Pour connaître les déclarations des candidats au poste de président élu de l'IEEE Canada et pour toutes autres mises à jour concernant l'élection, consultez le bulletin d'information électronique mensuel de l'IEEE Canada à : http://www.ieee.ca/news/ .

Le conseil a également discuté de la participation des sections de l'IEEE au prochain Congrès des sections qui se tiendra du 19 au 22 août 2011 à San Francisco. En plus du délégué officiel, chaque section de l'IEEE au Canada pourra envoyer un deuxième délégué. Le Congrès des sections est une excellente occasion d'en apprendre plus sur l'IEEE et d'établir des contacts avec des bénévoles de toutes les régions du monde.

Finalement, je vous souhaite à tous un été plaisant et divertissant. Vos commentaires et suggestions sont les bienvenus. Vous pouvez me les faire parvenir à maliko@ieee.org .

Om

Dr. Om Malik, P.Eng., LFIEEE, FCAE, CEIC, FEIT, FEIC

2010-2011 IEEE Canada President and Region 7 Director

Group photo of award recipients following IEEE Canada Awards Banquet, May 9, 2011, Niagara Falls, ON

From left to right: Amir Aghdam, Gregor Bochmann, Sandra Ingram (on behalf of Lindsay Ingram), Frank DeWinter, Jamal Deen, Hussein Mouftah (Awards and Recognition Committee Chair), Maike Luiken, Keith Hipel, William Gruver, Ashfaq (Kash) Hussain, Colin Clark

A View from the West

On: Best-to-Work-For Companies; Life Sciences Awards; Electronic Health Care; Canada's Largest Wind Farm; Engineers & Academia; Oilsands' Future; New Business With India; Innovative Insurance; "Green" Buildings; Mining in Manitoba; Modular Wheelchairs

By Terrance Malkinson

British Columbia

Leading the ranking for the third year in a row of BC Business's 9th annual "Best Companies to Work for in BC" is Strangeloop Networks Inc., a digital technology and technological services company, followed by Kryton International Inc., and Summerland & District Credit Union [*BC Business*. 38(12):64-81. December, 2010. www.bcbusinessonline.ca]. In addition to the overall ranking, rankings within industry sectors are provided. Clinton Hussey provides brief portraits of the companies.

LifeSciences British Columbia [www.lifesciencesbc.ca] has announced recipients of its 2011 annual awards. These awards recognize individuals and organizations that have made extraordinary contributions to the development of the life sciences industry in British Columbia. Awardees include: Genome BC Award for Scientific Excellence - Dr. Michael Hayden, Centre for Molecular Medicine and Therapeutics; Innovation and Achievement Award - Dr. Andre Marziali, Boreal Genomics and The University of British Columbia; Leadership Award - Mr. Paul Geyer, LightIntegra Technology Inc.; Medical Device Company of the Year - StarFish Medical; and the Dr. Don Rix Award for Lifetime Achievement - Dr. Judith Hall, Children's and Women's Health Centre of BC and The University of British Columbia.

A feature report by Jim Sutherland discusses Telus and its interest in the creation of technology platforms in electronic health care [*Canadian Business*. 84(3):32-36. February, 2011. www.canadianbusiness.com]. Currently involved in electronic medical records and personal health records, the company is interested in growth opportunities in electronic health care. Interconnectivity among physicians, hospitals, wards, laboratories, pharmacies and the patient is seen as having enormous benefits. The state of the art, and challenges and opportunities in this complex and important information technology field are discussed.

Alberta

Calgary-based Greengate Power Corporation [www.greengatepower.com] has received provincial approval to build Canada's largest wind farm near the community of Carmangay, AB. Expected to begin in 2012, with operation starting in 2013 this wind energy project will have a generating capacity of 300 megawatts. The Alberta Utilities Commission has conducted an extensive review of the project and found that it is in the public interest, with respect to its social, economic and environmental effects, supplying a clean source of electricity for an estimated 100,000 homes and reducing greenhouse gas emissions by 600,000 tonnes per year.

Engineers are making their mark as leaders of Canadian post-secondary institutions. Amit Chakma was named on July 1, 2009 as President and Vice-Chancellor of The University of Western Ontario, [www.uwo.ca]. Previously he was a professor in the Department of Chemical Engineering at the University of Waterloo; Dean of Engineering at the University of Regina, and began his academic career as a professor of chemical and petroleum engineering at the University of Calgary. A profile of the University of Calgary's new President Elizabeth Cannon is provided by Doug Horner in *Alberta Venture*. ["Mapping the Future". 15(1):58-63, January, 2011. www.albertaventure.com]. She is a pioneer researcher in geomatics engineering, and was previously Dean of Engineering. She has private sector experience contributing to the formation of the Tecterra Ingenuity Centre whose mission is focused on finding geomatics-based solutions to problems encountered by resource and technology companies.

An interview with Brian Ferguson President and CEO of Cenovus Energy on "The Future of Alberta's Oilsands" is provided by Derek Sankey in *Business in Calgary*. [21(3):29-33, March, 2011. www.businessincalgary.com]. Cenovus Energy is an integrated oil company employing a staff of about 3,500. As CEO he believes that people are critical to organizational success. In the article he discusses the challenges facing the formation of the $11.8B gross revenue company in December, 2009 and growth opportunities, environmentalism, and the future of the energy industry.

Saskatchewan

Group Medical Services [www.gms.ca] a rapidly growing provider in health and travel insurance and one of Saskatchewan's top 100 companies is profiled by Lyle Hewitt in "The Personal Approach". [*Saskatchewan Business Magazine*. 31(8):9-11. December, 2010]. Although founded 62 years ago as a Saskatchewan-only company, it expanded in 2003 across many Canadian provinces offering a variety of innovative insurance products.

International Road Dynamics Inc. [www.irdinc.com] recently signed two contracts worth $1.1M with India. They will supply a toll collection system for the Bandra-Worli Sea Link road project, which is projected to have a traffic volume of 37,000 vehicles per day, reducing travel time between Bandra and Worli to seven minutes. Another agreement involves the operations and maintenance contract for the 180-kilometre Delhi-Agra National Highway. This includes toll equipment, cash management, traffic management, road safety and route patrolling.

Manitoba

George Cibinel describes the design strategies and engineering used in a building originally commissioned by the Province of Manitoba for a five-week service life as the province's pavilion at the Vancouver 2010 Winter Olympic Games. This building has now been successfully relocated on the outskirts of Winnipeg. ["Centre Place Manitoba". *Sustainable Architecture and Building Magazine*. Issue #26. November-December, 2010. pp. 33-37. www.sabmagazine.com]. *SAB Mag*'s mission is to report on the progress of green building in Canada. Also in Canadian architecture, *Canadian Architect* published its 2010 listing of awards of excellence in its December issue [55(12). www.canadianarchitect.com]. The awards jury reviewed over 144 submissions of North American architectural excellence with many of the winners being Canadian.

The expansion of Manitoba's billion dollar mining sector is discussed by James Paris and Ritchie Gage in "The Search for New Ore" [*Manitoba Business Magazine*. 34(5):10-14. October-November, 2010]. Manitoba is seen as one of the most exploration-supportive, mineral-rich places in the world. The Manitoba Geological Survey is instrumental in the exploration activities of the private sector for both base and precious metals.

Further East: Reinventing the Wheel (Chair)

Since 2000, Christian Bagg, co-founder of Icon Wheelchairs, has been building wheelchairs that could change the wheelchair industry. In a partnership with the Ontario based manufacturing company Multimatic Inc. [www.multimatic.com], 100 chairs will be made available to consumers in August. His leading-edge adaptive modular wheelchair designs can be customized to meet the long-term needs of the user, something conventional wheelchairs cannot do. As quoted in a CBC news release ["New Wheel Chair called Revolutionary." February 28, 2011] Barry Lindemann, who speaks for the Canadian Paraplegic Association, said the new chair has created a buzz in the communit ... "and it's cool to think a Canadian is helping revolutionize the wheelchair world." Bagg is a paraplegic himself, and works with his partners, Michel Garneau and Paralympian Jeff Adams.

***Author biography*: see page 33**

On the Communication Requirements for Smart Grid

By *Mohamed Daoud[1], Member IEEE, Vaidehi Vijayakumar[2], and Xavier Fernando[1], Senior Member IEEE*

[1]Electrical and Computer Engineering Department Ryerson University, Toronto, ON, Canada
[2]Madras Institute of Technology, Anna University, India

Abstract

It is believed that the electric grid is the most complex and gigantic machine ever made in human history. This power grid is currently facing many challenges that it has not been originally engineered to handle. These are mainly due to distributed power generation from renewable, highly fluctuating, often micro scale sources. The current electric grid was established before 1960's and it consists of various, mostly static elements connected to allow unidirectional power flow. With the current distributed generation and increased consumer interaction, the grid is expected to be smart, allowing bidirectional power flow in an adaptive manner continuously optimizing the performance with self healing capabilities.

Various telecommunication technologies will play a key role in the upcoming smart grid. Since the power grid is so complex with multiple segments (core, distribution and access) and different applications (fault protection, demand prediction etc.), a single communication technology would be inadequate. A combination of multitude of technologies shall be used. This article provides an overview on various communication technologies for the smart grid in terms of configuration, bandwidth and latency requirements. Some simulation results are also given.

Sommaire

On croit que le réseau électrique est la machine la plus complexe et la plus colossale jamais réalisée dans l'histoire du homme. Ce réseau fait face actuellement à beaucoup de défis auxquels il n'avait pas été conçu à l'origine pour y faire face, particulièrement la production d'électricité distribuée à partir de sources renouvelables à petite échelle, fortement fluctuantes. Le réseau électrique présent a été établi avant les années 1960 et il se composait la plupart du temps d'éléments statiques reliés pour permettre un flux de puissance continu unidirectionnel. Avec la génération distribuée présente et l'interaction accrue avec le consommateur, on s'attend à ce que le réseau soit intelligent, permettant ainsi un flux de puissance bidirectionnel d'une façon adaptative optimisant sans interruption sa performance à l'aide de ses capacités autocuratives.

Les diverses technologies de télécommunications joueront un rôle principal dans les prochains réseaux intelligents. Étant donné que le réseau électrique est si complexe avec de multiples segments (noyau, distribution et accès) et différentes applications (protection de défaut, prévision de demande, etc.), une technologie de communication simple serait inadéquate. Une combinaison d'une multitude de technologies doit être employée. Cet article donne une vue d'ensemble des diverses technologies de communications pour le réseau intelligent en termes de conditions de configuration, de largeur de bande et de latence. Quelques résultats de simulation sont également donnés.

1.0 Introduction

The electric grid is probably the most complex and gigantic machine ever made in human history. The power grid just in the United States consists of 3,100 electric utilities operating more than 10,000 power plants. This grid serves 131 million customers consuming more than 3,500 billion kWh every day [2], [3]. This consists of 157,000 miles of high voltage electric transmission lines and most lines are 50-60 years old [4]. On the other hand, from 1988 to 1998, the electricity demand in the U.S. grew by 30%, yet only 15% of new transmission capacity has been added [1]. Similar scenario exists in Canada too. Hence, it can be seen that this giant machine, that needs to be operated under near optimum conditions, is aging and struggling to meet the increasing demand.

The current system is so inefficient that often customers have to call in to report faults. The failures can spread and affect large areas such as the black-out of summer 2003 in the northeastern U.S. and Canada. According to [3], power outages and power quality issues cost U.S. businesses more than $100 billion per year on average.

Carbon footprint due to electricity generation is huge; roughly 40 percent of North America's total emissions come from the production of electricity used in homes, offices, and factories [5]. This is expected to further increase with the vast introduction of electric vehicles. Therefore, naturally there is more effort to use renewable, non conventional sources for electricity generation. This has triggered biggest change in the grid since inspection. Since this attempt results in *distributed generation*, the power needs to flow bidirectional. This has introduced a completely new set of issues.

The renewable energy sources usually highly fluctuate which requires complex storage and load management issues. Peak production hours often do not sync with peak demand hours and often additional, carbon-intensive power plants need to be deployed during peak hours. Therefore, governments along with utilities have put up mechanisms to reduce peak demand, including time-of-use pricing, installation of load management devices and load shifting technologies.

All these factors indicate that the next generation power grid needs to have much more embedded intelligence, i.e., be "smart." Although there is much interest in the smart grid, not a single clear definition can be found that is complete. This shows the wide range of requirements and expectations from the smart grid. One definition says it can be described as an Advanced Metering Infrastructure (AMI) accompanied by substation and distribution automation services with enhanced outage management capabilities. The Electric Power Research Institute (EPRI) defines the smart grid as "a power system that serves millions of customers and has an intelligent communications infrastructure enabling timely, secure and adaptable information flow needed to provide power to an evolving digital economy" [7]. IEEE recently took the initiative to define standards and guidelines for the smart grid, namely the IEEE P2030 [3].

According to the United States Department of Energy's Modern Grid Initiative report, a modern smart grid must:

1. Be able to heal itself
2. Motivate consumers to actively participate in operations of the grid
3. Resist attacks
4. Provide higher quality power that will save money wasted from outages
5. Accommodate all generation and storage options
6. Enable electricity markets to flourish
7. Run more efficiently
8. Enable higher penetration of intermittent power generation sources

Smart grids will offer a system-wide "macro" view in aid of conserving electrical energy within the grid and related distribution systems. This is done by controlling and time shifting selected home appliances such as the air conditioners (peak saver), Plug in Hybrid Electrical Vehicles (PHEV) and washing machines and dryers [8]. These appliances also need to be smart, talking to the grid and automatically scheduling their activities for this [9]. The smart meter and a robust reliable communication network are essential here.

Smart grid can be described as an energy network just like the internet. Customers will download and upload electricity instead of data [28]. Rather than modems measuring the data flow, smart meters will measure the energy flow. Smart grid is where the information technology infrastructure will meet the electrical infrastructure; it will combine the maturity of the electric grid with the efficiency, connectivity, and cost gains brought by the advancements in the information technology [10].

For the foregoing, the smart grid has to have huge processing capacity. Individual processors must have a robust operating system and be able to act as agents that can communicate and cooperate with each other to compose a large distributed computing platform [6]. However, it seems that these are all impossible without various communication technologies, which have the potential to revolutionize the power grid and expedite renewable energy projects.

This paper presents an overview of the communications requirements for smart grid, highlighting some case studies. The rest of the paper is organized as follows: Section 2.0 presents the hierarchy of the communications system and also discusses latency, bandwidth, and Quality of Service (QoS). Section 3.0 is a description for all three layers of the network. Section 4.0 presents some of the work already done. Finally, Section 5.0 concludes the paper.

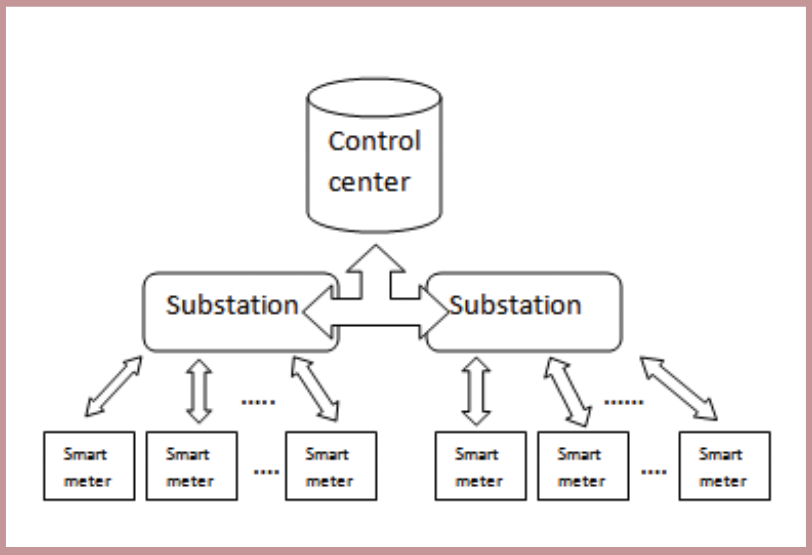

Figure 1: Smart Grid communication network

2.0 Communications for Smart Grid

Integrated, high performance, highly reliable, scalable, ubiquitous and secure: these are the characteristics that describe the smart grid communication network (SGCN). The SGCN will be responsible for gathering and routing data, monitoring all nodes and acting upon the data received.

The SGCN will be formed of millions of smart meters at customer premises connected to few thousand substations, which in turn will be connected to few hundred control centers and power plants. Considering the size of the SGCN, dividing them into clusters according to geographical locations is more convenient. Each cluster will have limited number of smart meters connected to a few substations and control centers. A cluster may or may not include a power plant. A single power plant can also be shared among more than one cluster.

Some of the data, related to grid operations carried by the SGCN, could carry very sensitive information. Keeping this information protected and preventing hackers from getting into the grid is a matter of national security. Therefore, the communication network must be secured against external attacks.

SGCN will depend on both wireless and wired communication technologies. However, since the wireless standards are changing fairly fast (every 4-6 years) while utilities are building systems for 15-20 years, it is not advisable to rely on a particular standard technology too much. Relying future proof protocols such as the IP (Internet Packet) protocol is, therefore, recommended.

In [28], S. Keshav and C. Rosenberg compared the smart grid communication network to the Internet, the largest communication network on earth. There are many similarities including distributed control. One main difference is the reliability; the SGCN is supposed to be available at every grid node with high reliability.

The communication requirements of the smart grid can be sorted into three main categories [20], [21]:

Real-time Operational Communications: This kind of communications is required to maintain the basic operation of the power system and include control and protection messages [20]. It requires low latency and high reliability.

Administrative Operational Communications: These are usually those messages that describe major and minor system disturbances like local event recorders, disturbance recorders, and power swing recorders. These do not need to take place in real time. This type of information is needed to predict future demand. This will also include prognosis and health monitoring of various grid equipment and data collection via various sensors.

Off-line Administrative Communications: These include the voice communications between different locations for administrative purposes. They can be carried over cellular or land line networks, and do not necessarily need to be part of the smart grid communications network.

Therefore, the SGCN shall support different QoS in order to prioritize the traffic on the network.

2.1 The SGCN hierarchy

The requirements and coverage areas of SGCN are so diverse; it will be a network of networks that may use different communications technologies.

We can consider three different layers in the SGCN, as described in [12].

The Core Network: This handles connectivity between substations and utilities' head offices (i.e. control centers).

The Distribution Network: As shown in Figure 1, the distribution network handles broadband connectivity for transmitting data collected by the smart meters sensors and concentrators located on the grid to their related databases and servers, which are located at headquarters.

The Access Network: The access network handles last-mile connectivity of end users (homes, offices, and municipal facilities) to the smart meters.

2.2 Requirements for Smart Grid communication network

Latency: Latency refers to the speed with which network data is transmitted. A high latency connection generally communicates less frequently and has longer delays. Some components of the SGCN will be more latency tolerant, such as smart meters and sensors. Other components such as distribution optimization systems are less latency-tolerant, whose response time needs to be less than a second.

Smart grid networks need to be built future proof for latency [29]. It is also important to consider instances when application requirements change in the operational context. For example, active demand response and emergency load management require higher reliability and lower latency as an integrated system than as part of a stand-alone AMI application. High latency may result in the control center missing some data. Then, it might substitute the missing input with inputs from other sensors which can produce different actions leading to erroneous results [14].

K. Moslehi et al. [24] discussed latency within the SGCN. They explained that the network will have different latency times; if the data sent is for the purpose of system wide coordinated controls it can have higher latency (slower cycle) than if the data is required for local analytical needs or responding for rapid events (faster cycle).

Bandwidth: Bandwidth represents the size of the data packages that can be sent via a network connection per given time or the data rate. As with latency, bandwidth requirement should accommodate the expected highest bandwidth application and number of nodes for future needs. Because of the extremely large number of endpoints, the bandwidth requirements can quickly become untenable if appropriate precautions are not taken. Bandwidth is a direct factor when choosing the transmission media (e.g. fiber optics, radio waves, coaxial cables, etc.) and the communications technology (e.g. 3G, LTE, WiMAX etc.). IEEE P2030 standard is still trying to precisely define the bandwidth requirements [22].

QoS: Not all messages have the same importance nor should they be delivered within the same latent period in SGCN. The diverse requirement in the QoS makes it more complex to universally handle as there will be many different applications penetrating the distribution grid. In

other words, it is believed that application-specific, single-purpose networks (such as SCADA) will be far too unmanageable in the smart grid scenario. A better, less costly strategy would be an integrated communications network supporting all applications, with proper implementation of QoS, reliability, security, and unified network management tools to ensure delivery of critical smart grid applications traffic.

3.0 Layers of the Network

3.1 Core network

The communications link has to be very reliable and secure in core networks with high bandwidth and low latency. In [23], K. Moslehi *et al.* have studied a Distributed Autonomous Real Time (DART) smart grid network that consists of 10 regions, each region having 20 control centers, and each control center having been connected to 500 substations. Every 10 substations are grouped into a zone according to the geographical area. From the study of the DART system, the latency between the 500 substations and their control centers averages to 240.8 ms. Note that this value measures latency in the system but does not indicate the maximum tolerable latency.

A snapshot taken at the control area in the DART system shows that the required transfer rate is 5.089 Mbps. This number is large due to the size of the DART system where 500 substations are connected to one control center. In a smaller system in [14], where only three voltages and currents need to be sampled and sent, 2-5 Mbps. Therefore, the bandwidth requirement really depends on the size (number of substations) of the control area.

In [14], V. K. Sood et al. also discussed the latency requirement and concluded that fault detection requires continuous high speed monitoring by the control centers. For rapid detection of such faults the latency should be in the order of 10 ms. For medium sized systems, this could be about 100 ms.

Different technologies can be used for different parts of the network as long as they can talk to each other with low latency. Optical fiber connections are recommended for communication in the core network because of their very low latency (typically 5 µs/km) [14] [15]. Installing fiber optics in core networks will not be an issue because of the low number of substations and head offices.

Usually network routers (where the communications protocols need to be translated) have long buffers and introduce latency. For example, a concatenated fiber-wireless link will offer much higher latency due to the additional header processing at the connection point.

3.2 Distribution network

The distribution network has slightly relaxed latency and bandwidth requirements. The typical latency measure between the smart meters and substations is 2.2 ms and between substations is 4.8 ms from DART system.

The maximum tolerable latency is higher than these. The latency is in the order of 10 ms in [3] and 12 ms in [23]. This means 6 ms one-way delay. These latency requirements change significantly in case of islanding. Islanding is the condition where the power grid is broken into independent asynchronous sections, each having its own generators and loads. According to the IEEE standard 1547-2003 the Distributed Resource (DR) must detect the unintentional islands and cease to energize them within 2 seconds of the formation of the island [14]. Unintentional islanding may lead to abnormal voltage and frequency change that is unacceptable. In [14] the latency in case of islanding was estimated to have a maximum value of 6 cycles or 100 ms.

P. Verma et al. in [3] proposed a method to calculate the bandwidth in distribution networks. They assumed a system of one transmission substation connected to one distribution substation and control center that is connected to 10,000 feeders. Each feeder is connected to 10 smart meters, making a total of 100,000 smart meters each sending one message per second in addition to the control messages. Thus, in a busy hour the system may have one million messages per second. Assuming that each message is 100 bits, that the latency requirement is 10 ms, and that the messages follow a Poisson distribution at each node, the bandwidth is calculated to be 100.01 Mbps. Repeating the same calculations for a 400 bit message, the bandwidth was found to be 400.04 Mbps. It was concluded that both of these situations result in very poor bandwidth utilization, while a higher level of utilization will not meet the assumed latency constraint [3].

Bandwidth utilizing is an important issue that needs to be carefully studied. C. H. Hauser et al. [16] proved that a T1 line carrying a 400 bit message with latency constraint of 10 ms results in utilizing only 6% of the T1 line capacity.

In the DART system in [24] and [23], the required transfer rate was found to be 3.31 Mbps in the substation and 8.1 Mbps within a zone formed of 10 geographically adjacent substations. According to their study, the size of a snapshot data describing the instantaneous status can vary between 2.5 kilobytes for a substation to 250 Megabytes for the entire grid [23]. This type of information is very useful for determining the required bandwidth.

The emerging broadband wireless access technology WiMAX seems to be a very good candidate for the distribution network. WiMAX has the benefits of fiber, such as low latency and large bandwidth. At the same time, it can be easily deployed as it needs no line of sight links and no expensive physical infrastructure as fiber. Other benefits of WiMAX are: (1) higher speed than 3G up to 75 Mbps; (2) up to 50 km air interface [11]; (3) QoS guarantee, and (4) adaptive modulation plus closed-loop power control. The third feature is ideal for the smart grid where some messages may be more important. For example, the control messages should have higher priority than billing messages [11]. The last feature enables WiMAX to maintain the QoS even during poor wireless channel conditions.

In [15], it was mentioned that wireless technology 4G (especially WiMAX) can be used for transferring data from smart meters in homes to transformer stations and control centers as it has high speed and low latency. Latency in a WiMAX link from the base station to CPE (customer premises equipment) shall typically be less than 10 ms [14].

3.3 Access network

The smart meter will not only show the customer's usage and generation, but it can also collect information from the smart appliances at home through an access network indicating the customer's behavior and informing the grid as shown in Figure 2.

The amount of data over the access network will depend on the number of smart appliances in the home. Not all appliances will be sending/receiving data at the same time. They will send/receive at scheduled times or when needed. It will be easy to design and manage the access network because of its small size and the limited amount of data to be transferred. In [15], an in-home network was mentioned where the smart appliances can communicate to the smart meter with a data rate of 20 Kbps while the maximum data rate is 128 Kbps.

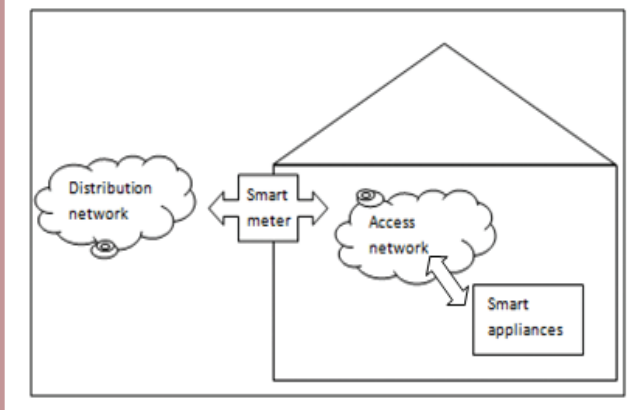

Figure 2: Smart meter collecting data from the access network inside a house and passing it to the distribution network

Such an access network can use any short range communication technology like ZigBee™ or Bluetooth™. In fact ZigBee™ is preferred because it consumes far less power than Bluetooth™. It is an open standard protocol based on IEEE802.15.4 designed for low cost communications. ZigBee™ nodes can sleep most of the time saving power and wake-up in 15 ms or less. However, the Zigbee™ network has a small range and limited data rate compared to fiber or WiMAX. Hence, it is more suitable for indoor applications like home automation [17].

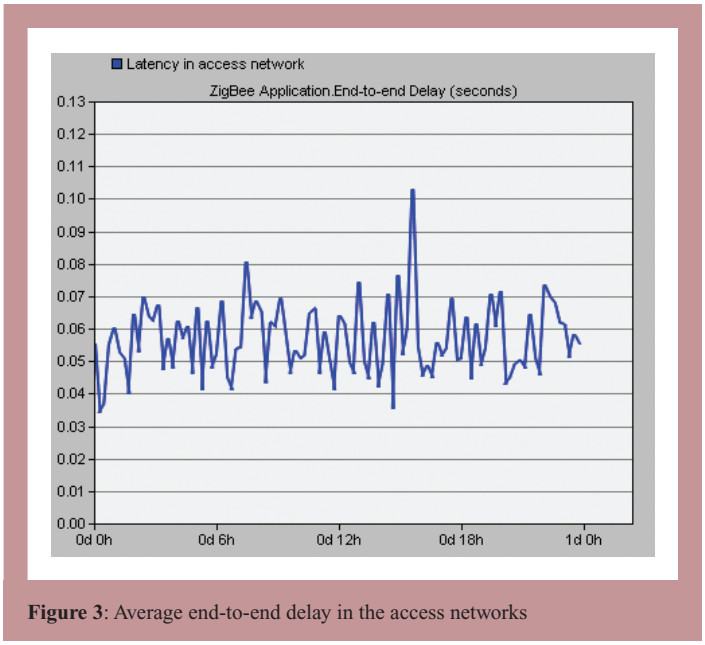

Figure 3: Average end-to-end delay in the access networks

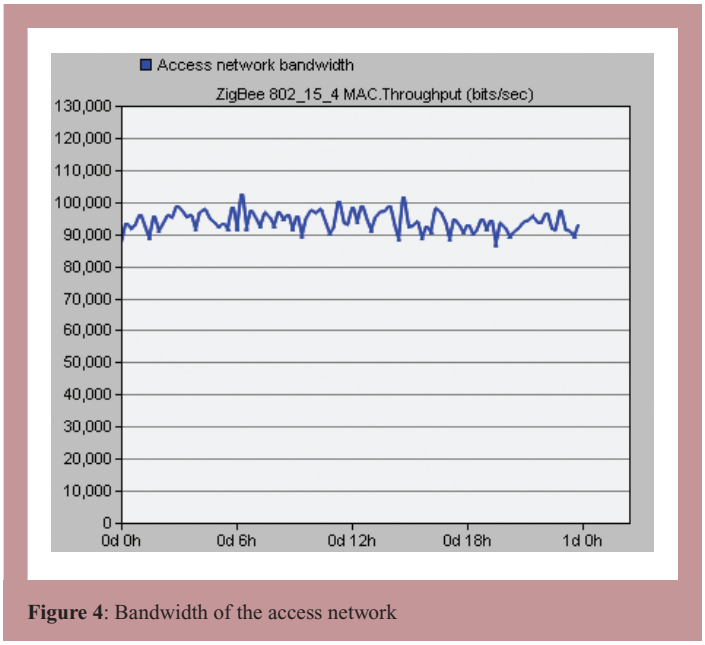

Figure 4: Bandwidth of the access network

Zigbee™ radio nodes are self organizing and self healing when forming mesh networks. Given the fact that IEEE 802.15.4 radio transmitters can successfully transmit packets to a distance of 50 m, nearly half the length of a football field, the smart meters can form mesh or star network with other meters in the neighborhood in addition to communicating with in-house appliances [17].

We did a simulation for an access network where we assumed a typical mid-size house with 11 smart devices communicating through a Zigbee™ network to the smart meter. We assumed Poisson distribution for packets generation at the smart devices with a constant packet size of 1 kilobyte. Packets are sent to the smart meter as soon as they are generated at the smart devices. We simulated 24 hours of traffic on the access network and found that the end-to-end delay in the network ranged between 35 ms and 80 ms, with a spike of 0.1 s during the peak hour of the day. Our results are shown in Figure 3. The average Bit Error Rate (BER) at the smart meter was 0.06 or 6%. In Figure 4, we plotted the data throughput over the day; it ranged from 90 Kbps to 100 Kbps which shows that the minimum required bandwidth should be a little bit over 100 Kbps.

Finally, a smart grid communication network will consist of different layers with each using a different technology. All these technologies should be able to communicate with each other, preferably using the same protocol. This should be the IP for the reasons described next.

3.4 Medium access control protocols

IP networks are widely used because of their open standard, simplicity, reliability, security, and robustness. The world is going towards the all-IP networks concept. IP is well-known to be used in the Internet, cellular networks, Wi-Fi, 3G, LTE (Long Term Evolution) and almost all new technologies. On the other hand, there is Asynchronous Transfer Mode (ATM), which is a packet-switching technology that delivers data packets over virtual circuits or preserved paths. ATM is a connection-oriented protocol with a fixed-length packet containing 53 bytes of information. Since the number of bytes is fixed, the transmission time of the cells is constant. This means that the cells can be switched at constant intervals. ATM is more expensive than IP, but it provides guaranteed latency and drop rates [18]. ATM is sometime used as the backbone of IP networks to implement point to point links.

IP is more popular than ATM due to its flexibility. IP seems to be a better option for easy integration of upcoming smart devices and sensors with other communication networks and the Internet. The cost of deployment and maintenance can be reduced significantly with the use of IP-based technologies [3], [15]. However, there is still an unsettled debate about the backbone of the smart grid communication networks, where the ATM appears to be a better candidate.

When talking about IP, it is necessary to mention the top layers. IP is usually backed with Transmission Control Protocol (TCP) to provide a higher delivery rate and retransmission in case of lost data [11], [18], [14], [16]. TCP is well-known for having the highest level of packet delivery assurance, but this comes at the price of higher latency due to the large overhead [14], [16]. However, it can still be used in combination with prioritization through QoS and can also be used for highly important applications that need assured delivery. User Datagram Protocol (UDP) is another layer that comes on top of IP, but compared to TCP, UDP is lightweight with smaller overhead and latency but at the cost of non assured data delivery because receipts are not acknowledged. A practical application of UDP is the multimedia features over the Internet, where the loss of some packets can be tolerated. By analogy, the same concept can be used for the SGCN. TCP could be used for messages that require high delivery rate like control messages while UDP can be used for sending data where the loss of some packets should not affect the overall performance of the system.

Currently, most IP networks are based on IPv4, but IPv6 protocol can also be used that has an address code set at 128 bit, which means that there are 2128 IP addresses available. IPv6 is supposed to be faster than IPv4, and maintain dialogue with any object such as household appliances, sensors, etc. [11]. While the IPv4 extensions allow multicast traffic and certain QoS, IPv6 is still preferred as it supports mobility and provides better security [15].

Although IP is preferred for SGCN, it is recommended to have the SGCN as a separate entity from the Internet as in [3] and [16]. The reason is that the public Internet lacks admission control and guaranteed latency delivery, and will never be able to act as the private data network for the power grid infrastructure. The lack of security of the Internet is another major concern.

4.0 Current Projects

A few noteworthy research projects on smart grids are listed below:

GAD project in Spain is targeting residential consumption. They developed a Domestic Power Manager (DPM) which is much like the smart meter, and took many steps in defining a communication network using open standard protocols to support active demand side management [15], [17].

GridStat is being developed by Washington State University. They are offering a flexible approach to providing communication support for electric power grid operations. It is based on a publish-subscribe (pub-sub) model, where the substations periodically publish status while the control centers and other substations subscribe to a selected set of statuses [16], [18].

DisPower, CRISP, MicroGrid and Fenix are different projects adopting the concept of an internet-like network in the sense that decision making is distributed all over the network since the control nodes are spread across the system [19].

Modern grid strategy [26] is a project by the U.S. Department of Energy (DOE) that started in 2005 through the National Energy Technology Laboratory (NETL). They are developing smart grid concepts and sharing it with key stock holders. Their mission is to accelerate

grid modernization in the U.S. They support the idea of using different communication technologies in different layers of the smart grid.

IntelliGrid is an initiative by EPRI to create the technical foundation for a smart power grid that links electricity with communications and computer control to achieve tremendous gains in reliability, capacity, and customer services. A major early product is the IntelliGrid Architecture, an open-standard, requirements-based approach for integrating data networks and equipment that enables interoperability between products and systems. This program provides utilities with the methodology, tools, and recommendations for standards and technologies when implementing systems such as advanced metering, distribution automation, demand response, and wide-area measurement [27].

5.0 Conclusion

This paper presented an overview of communication technologies for the smart grid considering the key requirements such as the latency, bandwidth and QoS. Several current active projects were mentioned as well. It was found that the latency within the distribution network should be kept less than 10 ms, and the transfer rate in case of a zone containing 10 substations should be around 8 Mbps. Our simulation results for the access layer give an indication of possible end-to-end delay and bandwidth. Also, it was concluded that no single communication technology will be able to satisfy the requirements for the whole network; rather, different technologies should be used for different parts.

There is still much work to be done in the smart grid field, especially in the communications part. Since most available communication techniques are off-the-shelf technologies designed for different purposes, they support features like mobility and handover that are not required for smart grids. None of them addresses the exact needs of the smart grid. Therefore, communication protocols should be developed and optimized specifically for smart grids that cover end-to-end networks. These protocols should be able to automatically set the QoS configurations and apply the self-healing communication network capabilities.

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Overvoltage Prevention in Residential Feeders with High Penetration of Photovoltaics

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Abstract

Overvoltages in low voltage (LV) feeders with high penetration of photovoltaics (PV) are usually prevented by limiting feeder's PV capacity to very conservative values, even if the critical periods rarely occur. This paper discusses the possibility of overvoltages in residential feeders with high penetration of PV, and the main factors that may lead to overvoltages. A state of the art review is performed regarding strategies that could be used to reduce the likelihood and magnitude of overvoltages, along with the main solutions for voltage control that can be applied in LV feeders with high penetration of PV.

Sommaire

Les surtensions dans les alimentations à basse tension (BT) et haute pénétration photovoltaïques (PV) sont généralement évitées en limitant la capacité de l`alimentation PV à des valeurs très conservatrices même si les périodes critiques ne se produisent pas très souvent. Cet article discute la possibilité d`avoir des surtensions dans les alimentations résidentielles à haute pénétration PV. Le problème de l`augmentation de la tension grâce à la haute pénétration PV dans les alimentations résidentielles et les principaux facteurs qui peuvent conduire à ces surtensions sont discutées. Un état de l'art est réalisé sur les stratégies qui pourraient être utilisées afin de réduire la probabilité et l'amplitude de ces surtensions et les principales solutions de contrôle de la tension qui peut être appliquée dans les alimentations BT à haute pénétration PV.

1.0 Introduction

Photovoltaics (PV) technology utilization is growing in an accelerated manner in Canada. From 2008 to 2009, the installed PV power capacity almost tripled, reaching 94.6 MW in the last Canadian PV status report [1]. Eleven percent of the PV systems installed in 2009 were for residential and building-integrated grid-connected applications; most of this growth being fostered by the province of Ontario green energy policies. These numbers promise to rise even more as a result of Ontario's successful feed-in tariff programs [2]. For instance, in February 2011, there were about 25,000 applications for small renewable projects with generating capacity of 10kW or less, 99% of which were PV systems. If all these applications were accepted, suddenly about 234 MW of small PV systems would be connected to Ontario's power network. This brings several advantages; for instance, by generating electricity closer to consumers, it is possible to reduce distribution and transmission system congestion and power losses. This feature can be of pivotal importance for the deployment of electric and plug-in hybrid electric vehicles (EV and PHEV) which will put a significant stress on the transmission and distribution systems. However, the use of distributed generation (DG) at the distribution level does not come without technical challenges. One of the main issues is related to voltage regulation in distribution feeders.

Distribution systems have been designed for many years to have unidirectional power flow. From the moment that DG units are integrated into the grid, the power does not flow only from the distribution transformers to the costumers anymore. Now, customers are also capable of supplying power to the grid. In this context, during high generation and low load periods, there is a possibility of reverse power flow, and consequently voltage rise [3-9]. This can lead to overvoltages in the feeder, being one of the main reasons for limiting the capacity (active power) of non-dispatchable DG, such as PV, that can be connected to a low voltage (LV) distribution system [5]. For instance, Germany limits the maximum voltage increase to 2% of the rated voltage due to the integration of DGs on LV distribution systems [10].

Residential feeders with PV systems can be considered a critical case regarding overvoltage. The typical load profile of residential feeders presents a peak value during night time when there is little or no PV generation. On the other hand, the demand is relatively low during power generation peaks, leading to reverse power flow in the feeder and consequently overvoltage. Conversely, the typical load profiles of commercial and industrial feeders present a good correlation with the typical PV power profile [11], which tends to reduce the likelihood and magnitude of overvoltages for the same ratio of peak load and peak power generation.

The overvoltage issue in residential feeders with high penetration of PV and the main solutions available are discussed in this paper. The voltage rise due to high penetration of PV systems in residential feeders and the main factors that may lead to overvoltages are presented in Section 2.0. The main solutions for voltage control that can be applied in LV feeders with high penetration of PV and its suitability are presented in Section 3.0. Finally, the conclusions are stated in Section 4.0.

2.0 Voltage rise in LV feeders with high penetration of PV

CAN CSA C22.2 No. 257-06 [12] specifies the electrical requirements for inverter-based micro-distributed resource systems interconnection to LV grids in Canada. This standard recommends using the CSA CAN3-C235 [13] as guidance for appropriate distribution system steady-state voltage levels. Based on these standards, for single-phase connection, normal operating conditions (normal range; NR) occur when the voltage level is within 0.917 and 1.042 pu. On extreme operating conditions, the steady-state voltage limits are 0.88 pu and 1.058 pu. It is worth mentioning that although networks are allowed to operate under extreme conditions (ER), improvement or corrective action should be taken on a planned and programmed basis. In general, the voltage limits established for inverter protection (0.88 and 1.1 pu of voltage [14, 15]) are mostly beyond the recommended voltage limits for distribution networks. Thus, the feeder may be experiencing overvoltage while the inverter protection does not reach its threshold value.

LV distribution feeders are conceived to supply a certain load at a certain distance without considering distributed generation. At the planning stage, they are designed to allow a maximum of 5% voltage drop from the secondary side of the LV network transformer to the customer meter. It is a common practice in certain weak feeders to adjust the tap of LV transformers stepping-up the voltage in order to comply with voltage level requirements under peak load condition. This means that the voltage in the beginning of the feeder may be adjusted to operate 3-4% above the rated value. This leaves little or no margin for having reverse power flow in these feeders.

Another important aspect is that the voltage sensitivity to active power variations is higher in LV feeders than in MV feeders. Consider a simple 2-bus system where the voltage rise at the end of the line with respect to that in the beginning of the feeder (ΔV) can be approximated by [16]:

$$\Delta V \approx \frac{PR + QX}{V} \quad (1)$$

Where P and Q are the active and reactive powers injected by a PV inverter and R and X are the resistance and reactance of the feeder. LV feeders are characterized as having large resistance-reactance ratios (R/X). This means that active power variations have a large influence in voltage variations in LV feeders. Along with the fact that the load does not necessarily correlate with generation, the main conditions for having overvoltages due to voltage rise caused by non-dispatchable DG units are related to the grid architecture, and load/generation profile.

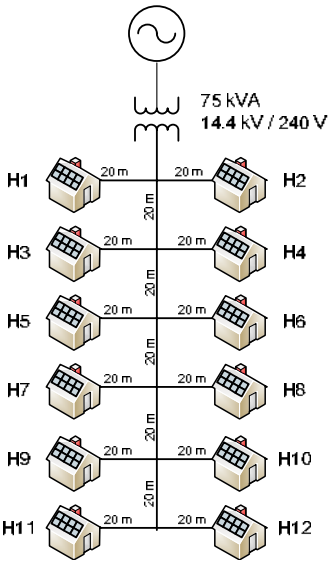

Figure 1: Overhead residential test feeder [17].

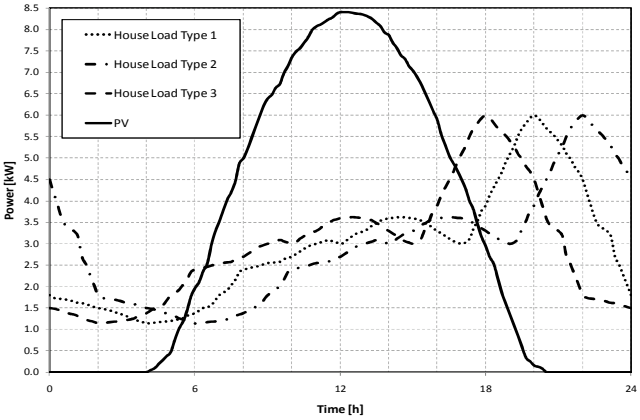

Figure 2: House load profile and PV production over 24 hours in Summer

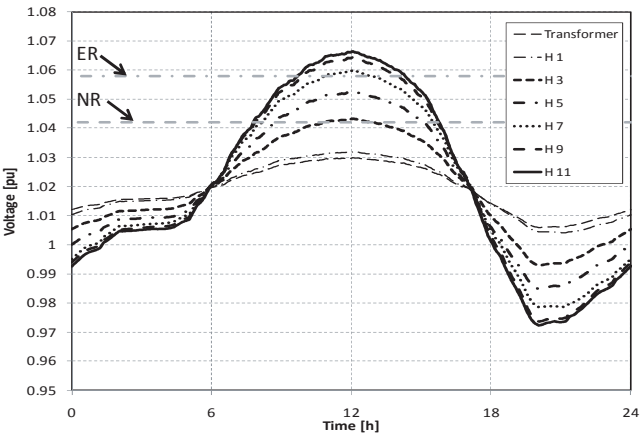

Figure 3: Typical 24-h voltage profile in summer

2.1 Effect of load and generation profile on the voltage rise

Fig. 1 presents a typical 240 V / 75 kVA Canadian suburban distribution feeder with 12 houses with roof-top PV systems from a previous simulation study [17] that investigated the voltage rise in residential feeders with high penetration of PV. The house characteristics for the voltage profile study were based on the Alstonvale net-zero energy solar house (ANZH) [18]. The ANZH is able to generate as much power as it consumes in one year. It presents a building-integrated photovoltaic thermal (BIPV/T) rooftop system, which is capable of generating 22 kWp of thermal energy and 8.4 kWp of electrical energy.

The summer loads and PV profiles are presented in Fig. 2. The peak load occurs from 18-22 h, when there is little or no PV generation. It can be observed that for about an 11-hour period (6-17 h), there is more energy being produced by the PVs than consumed by the loads. In this case, the feeder would be exporting active power to the grid (transformer). Fig. 3 presents the feeder's voltage profile for the odd houses (the results for the even houses were omitted as they are similar). The maximum voltage in the system (1.066 pu) occurred at noon, in houses 11 and 12, at the end of the feeder. There, the voltage exceeded the extreme operation condition from 9:40 h to 14:10 h (19% of the day). Houses 7 to 12 experience overvoltages (above 1.058 pu) for at least a small period of time during the day. This is a typical example of the fact that the PV generation and residential loads are not typically correlated and can lead to overvoltages in the LV section of the feeder.

2.2 Case studies regarding voltage rise due to PV systems

Several studies were carried out on voltage rise in LV distribution system in the presence of PVs [3, 5, 6, 9, 17, 19-21]. Cases where the distribution feeders were conceived to cope with the integration of PV were presented in [3, 9]. Few studies discuss the impact of PVs in overvoltages on feeders that were already built before considering the integration of PV systems [19, 21]. A simulation study on the impact on the feeder's voltage profile with 216 residences integrating grid-connected PV using typical Canadian feeders parameters is presented in [21]. It was found that overvoltage may occur in suburban and rural feeders. For instance, in the particular suburban feeder presented, if more than 2.5 kW per household of PV panels were installed, overvoltage could occur. In addition, feeder impedance, feeder length, and transformer impedance were shown to play important roles in determining the voltage rise for residential feeders with high PV penetration levels.

A detailed US monitoring study for a neighbourhood of 115 houses with 2 kW of PV for a total capacity of 230 kW connected in a 20 MVA substation was presented in [9]. Only a slight voltage rise of approximately 0.6% was observed on clear days, which is expected for a relatively low penetration level.

Several studies considering urban real estate developments in Germany, Netherlands and France with penetration capacity reaching 110% of LV transformer capacity (Germany) were investigated [3]. According to European standards, the voltage level increases were within the normal range (0.9 and 1.1 pu - EN 50160). However their standards are more relaxed as compared with the North-American ones. The voltage reached about 1.06 pu in Freiburg, Germany and Heerhugowaard, Netherlands and 1.05 pu in Soleil-Marguerite, France. The level of penetration in these sites are higher as compared with the US case presented in [9]. As already mentioned, in both reports the feeders were designed to receive PV systems.

A current network in the city of Leicester in UK, that did not include PV resources, was modeled using a stochastic approach and one-minute data information about house/load consumption and the solar irradiance data obtained for the region [19]. Overvoltages were observed in this feeder in the case that included 1.8 kW PV systems in 50% of the 1262 houses.

3.0 Voltage control solutions for LV feeders with high penetration of PV

This section discusses the main solutions available in the literature for voltage control that can be applied to LV feeders with high penetration of non-dispatchable DGs. The definition of the best strategy to avoid overvoltages for a certain feeder is quite site dependent as regulations

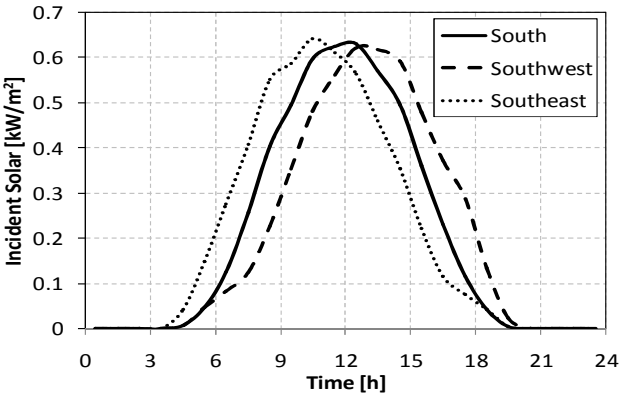

Figure 4: Average daily incident solar power profile of July for south (0° azimuth), southeast (-45° azimuth) and southwest (45° azimuth) facing panels mounted in Montreal with slope of 45°.

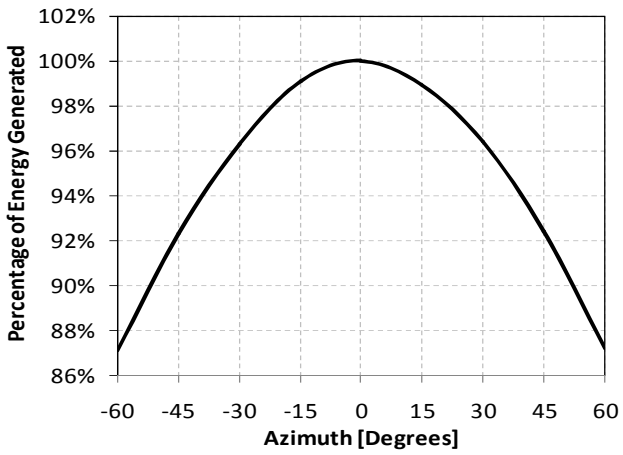

Figure 5: Impact of varying the azimuth angle (orientation) from south on the yearly energy generation of a PV panel (location: Montreal; slope equals latitude).

and characteristics may differ from one case to another. In addition, a combination of approaches could also be used in order to plan for load and generation growth.

3.1 Secondary LV transformer tap adjustment [22] and conductors section increase [23]

Readjusting the tap of the LV transformer can be very effective. The main challenge, assuming that the tap cannot be changed frequently, is being able to find a setting that can be used for rated generation of PV and for no generation of PV without violating the voltage limits. A rule of thumb approach to define the appropriate voltage in the secondary of the transformer is presented in [22]. The idea is to adjust the voltage halfway between the upper and lower voltage limits. This ensures that the voltage rise/drop will have the same range of operation. If the undervoltage limits are not reached during a period operating at rated load and no PV generation, then, during rated PV generation and no load, the overvoltage limits are not going to be reached either. However, this is not possible for all feeders as, in some cases, decreasing the LV transformer's voltage can lead to undervoltages.

Another passive approach is to upgrade the conductors. Increasing the section of the wires reduces its resistance and reduces the voltage rise/drop in the feeder. For instance, changing the cables of a particular section of the feeder from a NS90 3/0 AWG to a 4/0 AWG cable (aluminum, XLPE) would lead to about 20% reduction in the line equivalent resistance per kilometer. Consequently, the voltage rise/drop in this section of the feeder is reduced, as can be seen from equation (1). Besides, it reduces losses in the feeder. However this can be considered an expensive approach, especially for underground feeders.

3.2 Install auto-transformers/voltage regulators [23-25]

Auto-transformers/voltage regulators are already being widely used in the distribution networks. Basically these regulators consist of transformers that have multiple taps in one of the sides that are automatically changed according to a control algorithm by an on-load tap changer. Changing the tap that is connected to the grid, changes the turns ratio of the transformer, so that the secondary voltage is increased or decreased. The change of the tap is made by on-load tap changers, according to the voltage variation downstream the regulator. The control can include line-drop compensation or can use some sort of communication link to monitor the voltage in a particular point. The main issue regarding voltage regulators is that they introduce another unreliability factor into the system, that should be considered by local distribution network operators.

3.3 Azimuth diversification of PV panels

Another way to reduce the magnitude of the voltage rise, and, consequently, the likelihood and magnitude of overvoltages, is the diversification of the azimuth of the PV panels. The azimuth (solar orientation) is the angle clockwise from true north of the direction that the PV array faces. Usually, PV systems in the northern hemisphere are placed facing south (azimuth = 0°), to achieve the highest annual energy yield. However, having all houses in a PV feeder with panels due south, as presented in [17], brings the peak power generation time of all the PV panels to be around noon. This can create a larger surplus of active power in the system, and consequently, higher probability of occurrence of overvoltage in a feeder than if the PV systems are installed with different azimuths. Increasing the azimuth angle favors afternoon energy production, while decreasing the azimuth angle favors morning energy production [26] as shown in Figure 4 (SW = 45° and SE = -45°).

Figure 5 shows the variation of yearly PV panel generation with the azimuth. Comparing southwest and southeast orientations with south there is a loss of about 8% on the yearly energy yields.

As noted in [27], the azimuth diversification strategy will not drastically affect the yearly net energy generation level but can provide a smoother peak hour generation. However this strategy by itself cannot guarantee that no overvoltages would occur, but can reduce their magnitude and frequency. In the following section, the main approaches used to avoid overvoltages are discussed.

3.4 Allow the PV inverters to absorb reactive power [28-32]

PV inverters mainly inject all the active power available from the PV systems to the grid. The main idea to control the voltage locally is to allow inverters to inject reactive power together with active power. From equation (1), one can see that voltage decreases as the inverter draws reactive power. So, to control the voltage, a certain amount of reactive power could be absorbed by the PV inverters, reducing the voltage rise in the system.

In Canada, according to [12], a small power producer should not interfere with the voltage control of the feeder using reactive power in LV systems, unless in agreement with the utility. However, the inverters may operate with power factor below 1 up to but above 0.85, leading or lagging. In some other countries, reactive power cannot be absorbed at all by inverters connected to the LV system [33, 34]. Thus, overvoltage prevention through reactive power control cannot be used in these cases.

In places where this practice is not disallowed, the extra stress added to the feeder should be considered. This is due to the fact that when one increases the reactive power flow in the feeder, the RMS value of the current is also increased. Moreover, from [17], one can calculate the amount of reactive power required at the end of the feeder to keep the voltage there constant at the maximum voltage allowed for a certain increase in the injected active power (ΔP), as

$$Q = -\Delta P \frac{R}{X} \quad (2)$$

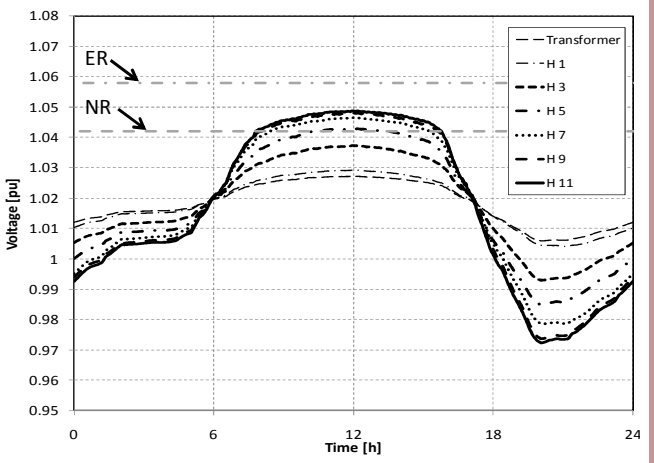

Figure 6: Typical 24-h voltage profile with APC.

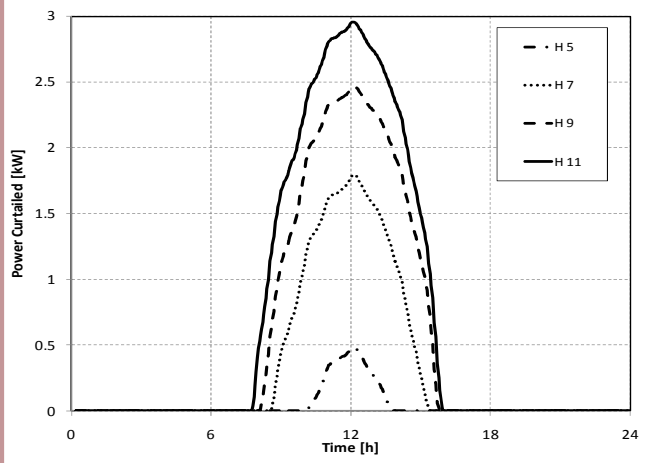

Figure 7: Power curtailed by APC in each house

From (2), one can conclude that as the factor R/X increases, higher values of reactive power injection are required to prevent overvoltage. This will demand inverter(s) with higher power capacity, resulting in higher currents, and losses, in the feeder and also in lower power factors at the input of the feeder.

3.5 Curtail the power of DG units [4, 8, 17, 23]

The option of active power curtailment (APC) seems very attractive because it requires minor modifications in the PV's inverter control logic. Besides, it is only activated when needed, thus minimizing the amount of curtailed active power (also known as output power losses [5]).

Usually grid-tie inverters are controlled as current sources with maximum power point tracking (MPPT) algorithms to be able to extract the maximum power available (P_{MPPT}) in the PV array for a given solar irradiance. A droop based APC method is presented in [17]. When the voltage is above a certain value (V_{cri}), the power injected by the inverter (P_{inv}) is a function of the bus voltage (V) according to

$$P_{inv} = P_{MPPT} - m\left(V - V_{cri}\right) \tag{3}$$

This is valid only for $V \geq V_{cri}$ and $P_{inv} \geq 0$. In this equation, m is a slope factor (kW/V) and V_{cri} is the voltage (V) above which the power injected by the inverter is decreased with a droop factor. For $V < V_{cri}$ the inverter injects P_{MPPT}, as most PV inverters do. The local voltage determines how much power should be curtailed from each PV inverter. The droop coefficients of the inverters (m and V_{cri}) can be selected for the inverters to comply with the voltage limits at their connection buses. Also, they can be used to coordinate the PV inverters, distributing the active power curtailment required for keeping all bus voltages within the acceptable range, without a dedicated communication channel.

The droop parameters are selected so that APC only occurs for local voltages between 1.042 pu (maximum voltage level in normal range) and 1.058 pu (extreme operation conditions). V_{cri} is defined as the voltage at which the curtailment starts: 1.042 pu. In a 240 V rated system, it is 250 V.

Fig. 6 presents the voltage profile with the inverters using the droop-based APC. The maximum voltage in the system (1.049 pu) occurs at noon, in houses 11 and 12. The power curtailed in each house by the PV inverter is presented in Fig. 7. The last house had almost 3 kW curtailed at noon. This amount was reduced for houses closer to the LV transformer. On the other hand, houses 1 to 4 did not have any power curtailed at any moment.

The main issue regarding APC is that it is in feeders that overvoltage often occurs. This creates a large amount of power being curtailed from the PV systems, reducing the revenues of customers. However, this level of curtailment can be monitored, so that an option to upgrade the feeder can be postponed to a time that the generation capacity reaches a certain point.

3.6 Demand side management

A possible approach for reducing overvoltage occurrences in LV residential feeders is the utilization of demand side management. Having some controllable residential loads that could shift the period of operation to moments of excess power can alleviate the overvoltage issue. The performance of a voltage control strategy using electric water heaters is presented in [35]. Often the operation of such controllable loads is combined with time-of-use pricing or other price differentiation dynamics in order to achieve better performances [36].

Another strategy, that also considers the active power management, is the utilization of storage units to absorb the power that would be curtailed to avoid overvoltages for later use [20]. A study in Japan including more than 500 houses with PV systems investigated the losses incurred from the PV inverter's overvoltage protection circuits [5, 20], including battery-integrated PV systems using lead-acid batteries. The results showed that the additional losses due to the installation of the batteries were larger than the amount of energy saved. One of the reasons pointed out was that overvoltages were rare in that system (0.3% of the year under study).

Besides, energy storage units are usually expensive and the cost benefit ratio can be low if they have to be sized to store the surplus of high penetration of PVs. Having said that, further investigation regarding design and optimization of the operation of battery-integrated PV systems is necessary, including the possibility of combining other functions with the PV systems (e.g., peak shaving, voltage fluctuations reduction, etc.) in order to add value.

4.0 Conclusion

A state of the art review regarding the overvoltage issue in LV feeders with high penetration of PV was presented in this paper. The likelihood of overvoltage is higher in weak suburban and rural feeders. The main factors that contribute to overvoltages are the penetration level of PV systems and low correlation with residential loads, feeder impedance and length, and LV transformer's impedance and tap adjustment. The use of demand side management and azimuth diversification of PV panels can reduce the likelihood and magnitude of overvoltages. In addition, a review of some of the promising approaches for voltage control in LV feeders was presented. The identification of the best strategy to avoid overvoltages in a certain feeder should be taken in a case-by-case basis, considering local standards and economical impact.

Acknowledgements

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About the Authors

Reinaldo Tonkoski (S'04) received his B.A.Sc. degree in Control and Automation Engineering in 2004 and M.Sc. in Electrical Engineering in 2006 from PUC-RS (Pontifícia Universidade Católica do RS), Brazil. Presently he is pursuing his Ph. D. at Concordia University, Canada. He joined CanmetENERGY, Natural Resources Canada, from January 2009 to January 2010 where he worked on projects related to grid integration of renewable energy sources. He is member of IEEE and his research interest includes grid integration of renewable energy systems, distributed generation, power quality and power electronics.

Luiz A. C. Lopes (S'93–M'96–SM'06) received the M.Sc. degree from the Federal University of Santa Catarina, Florianopolis, Brazil, in 1989, and the Ph.D. degree from McGill University, Montreal, QC, Canada, in 1996. From 1996 to 2001, he was an Associate Professor in the Department of Electrical and Computer Engineering, Federal University of Para, Belem, Brazil. He is currently an Associate Professor in the Department of Electrical and Computer Engineering, Concordia University, Montreal, which he joined in 2002. His current research interests include distributed power systems and renewable energy sources.

Awards Presentation

Remise des prix

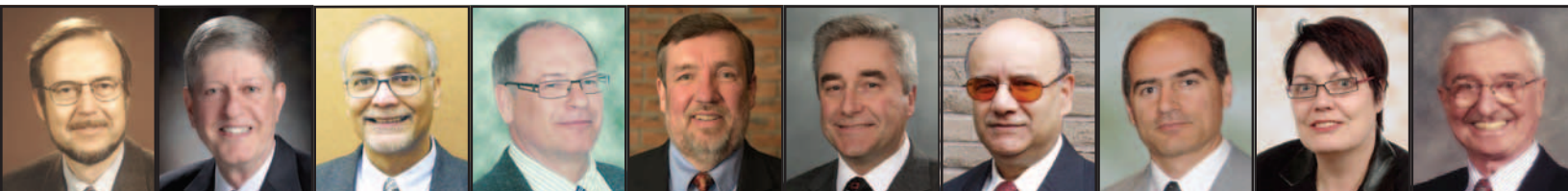
24th Canadian Conference on Electrical and Computer Engineering

24ième Conférence canadienne de génie électrique et informatique

IEEE Canada

May 9—9 Mai, 2011; Niagara Falls, ON

http://www.ieee.ca/awards



IEEE Canada 2011

Awards Programme
Programme des Prix

Awards presented in reverse order/ Prix présentés en ordre inverse

IEEE Canada Achievement Awards

A.G.L. McNaughton Gold Medal for exemplary contributions to the engineering profession.

R.A. Fessenden Medal for important contributions to the field of telecommunications engineering.

Power Medal for important contributions to the field of electric power engineering.

Computer Medal for important contributions to the field of computer engineering and science.

Outstanding Engineering Educator Award for outstanding contributions to engineering education.

Robert H. Tanner Industry Leadership Award for important leadership contributions in Canadian industry where there is significant activity in areas of interest to IEEE.

IEEE Canada Service Awards

W.S. Read Outstanding Service Award for outstanding and sustained service to IEEE Canada and the Institute.

J.J. Archambault Eastern Canada Merit Award for meritorious service in eastern Canada at the local IEEE Section and Area level.

M.B. Broughton Central Canada Merit Award for meritorious service in central Canada at the local IEEE Section and Area level.

E.F. Glass Western Canada Merit Award for meritorious service in western Canada at the local IEEE Section and Area level.

Prix de distinction honorifique 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 en Puissance pour contributions importantes dans le domaine du génie électrique.

Médaille en Informatique pour contributions importantes en informatique.

Prix d'excellence en enseignement du génie pour contributions exceptionnelles à l'éducation en génie.

Prix leadership industriel Robert 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.

Prix pour états de services de l'IEEE Canada

Prix d'excellence de service W.S. Read pour service exceptionnel et soutenu à l'IEEE Canada et à l'institut.

Prix 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.

Prix 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.

Prix 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.

Nomination Process

The accomplishments of our 10 Award recipients speak for themselves, as summarized in their following biographies. But it was words on a nomination form that launched each of their journeys to the IEEE Canada podium.

Why nominate? When we celebrate the successes of our colleagues, we can also celebrate our membership in this most special of Regions in IEEE, Region 7, also known as IEEE Canada — special because we are the only Region whose geographic boundaries totally encompass a single country, and only that country.

To find the best and the brightest, IEEE Canada depends upon nominations from across our diverse spectrum of technical interests, in both established fields and those just emerging. We also recognize those who give of their time and energy to help sustain and grow our organization. Without the countless unpaid hours, there would be no IEEE Canada to give out Awards. While experience gained in volunteering is its own reward, a public "thank-you" never hurts. If an IEEE colleague has made a difference, let us know how.

On-line Forms Make it Simple

With our on-line nomination process, it's easy: the nominator completes a web form outlining the importance of the nominee's contribution; two endorsers then confirm/elaborate with a second form. Anyone (including non-members) can nominate but only IEEE members (from any Region) can endorse. Nominees for achievement and service awards must be Canadian IEEE members, but the industry leadership award is open.
See http://www.ieee.ca/awards/nominate.htm

Critical Dates

- Nominations and endorsements must be received by: November 30, 2011
- Recipients selected by Awards committee and appproved: December 2011
- Presentations: Spring 2012 during the CCECE in Montreal

Processus de mise en candidature

Les accomplissements de nos 10 récipiendaires parlent d'eux-mêmes, comme on peut le constater dans les biographies suivantes. Mais ce sont les mots écrits sur les formulaires de mise en candidature qui les ont menés au podium de l'IEEE Canada.

Pourquoi proposer un candidat ou une candidate? Lorsque nous célébrons les succès de nos collègues, nous pouvons également célébrer notre appartenance à la plus spéciale des régions de l'IEEE, la région 7, également connue sous le nom d'IEEE Canada — spéciale parce que nous sommes la seule région dont les frontières géographiques englobent totalement un pays, et seulement ce pays.

Afin de trouver les meilleurs candidat(e)s, l'IEEE Canada dépend des candidatures provenant de secteurs techniques divers, de domaines établis ou émergents. Nous reconnaissons également ceux qui donnent temps et énergie à notre organisation. Sans ces heures innombrables de bénévolat, il n'y aurait pas d'IEEE Canada pour décerner des prix. Même si l'expérience de bénévolat constitue pour chacun sa propre récompense, un « merci » formulé en public ne fait jamais de tort. Si vous connaissez un(e) collègue de l'IEEE qui s'est démarqué(e), prévenez-nous.

Les formulaires en ligne simplifient l'exercice

Avec notre processus en ligne de mise en candidature, c'est facile: le proposeur remplit un formulaire web décrivant l'importance de la personne proposée; deux membres alors confirment/élaborent avec un deuxième formulaire. N'importe qui (y compris des non-membres) peut procéder à la mise en candidature mais seulement des membres de l'IEEE (de toute région) peuvent l'appuyer. Les personnes proposées pour des prix d'accomplissement et de service doivent être des membres canadiens de l'IEEE, mais le prix de leadership industriel est ouvert à tous. Voir le site http://www.ieee.ca/prix/icanprix.htm

Dates importantes

- Les mises en candidatures et les appuis doivent être reçus d'ici le : 30 novembre 2011
- Récipiendaires sélectionnés par le comité des prix et approuvés : Déc. 2011
- Présentations : Printemps 2012 pendant la CCGÉI à Montréal

2011 IEEE Canada A.G.L. McNaughton Gold Medal

For outstanding contributions to the development of design methods for communication protocols and services

Gregor v. Bochmann (FIEEE) is professor at the School of Information Technology and Engineering at the University of Ottawa since 1998, after 25 years at the University of Montreal. He is a Fellow of IEEE, ACM and the Royal Society of Canada. After initial research work on programming languages and compiler design, he started work on communication protocols around 1974 and developed the field of "protocol engineering," applying software engineering principles to communication protocols. In the early eighties, he participated in standardization committees of ISO and ITU and took a leading role in the standardization of Formal Description Techniques for communication protocols and services at the Canadian and international levels. He is internationally well recognized for his innovative work on modeling the behavior of distributed systems by extended finite state machines, and on their verification and testing. He has had many research collaborations with industry and, from 1989 to 1997, held the Hewlett-Packard - NSERC - CITI Industrial Research Chair on communication protocols at the University of Montreal.

Dr. Bochmann has received many prizes for his work, including the Thomas W. Eadie Medal of the Royal Society, the Award for Excellence in Research of the University of Ottawa, and in 2005 was recognized as a "Pioneer of Computing in Canada" at the CASCON conference organized by IBM and NRC. His recent work has been in the areas of software engineering for distributed applications, peer-to-peer systems, quality of service and security management for Web applications, and control procedures for optical networks.

2011 IEEE Canada R.A. Fessenden Medal

For pioneering contributions in electronics and optoelectronics for communications

M. Jamal Deen (FIEEE) is the Canada Research Chair in Information Technology and Professor, at McMaster University. Earning his BSc from the University of Guyana, his achievements won him the Chancellor's Medal and the Dr. Adler's Prize. At Case Western Reserve University (MS and PhD), he was a Fulbright-LASPAU Scholar and an American Vacuum Society Scholar for his graduate work. His doctoral work there on designing and modeling of a new Raman spectrometer for dynamic temperature measurements and combustion optimization in rocket and jet engines, was sponsored and used by NASA, Cleveland, USA. His research record includes approximately 430 peer-reviewed articles, seven best-paper awards and six patents that were used in industry.

Dr. Deen is regarded as the world's foremost authority in modeling and noise of electronic and optoelectronic devices for communication systems. He has successfully transferred powerful engineering and circuit models for designing communication circuits to numerous companies. His practical models for high-performance optical detectors and experimental innovations for reliability prediction have contributed to the design and manufacture of reliable photodetectors for fiber optic communications.

Dr. Deen's peers have elected him to Fellow status in eight national academies and professional organizations, including Fellow of The Royal Society of Canada (RSC), The American Physical Society and The Electrochemical Society. His other awards include the 2002 Callinan Award and the 2011 Electronics and Photonics Division Award from the Electrochemical Society; a Humboldt Research Award from the Humboldt Foundation, Germany, in 2006; and the 2008 Eadie Medal from the RSC.

Médaille d'or A.G.L. McNaughton de l'IEEE Canada 2011

Pour contributions exceptionnelles à l'élaboration des méthodes de conception des protocoles et services de communication

Gregor v. Bochmann (FIEEE) est professeur à l'École d'ingénierie et de technologie de l'information de l'Université d'Ottawa depuis 1998, après 25 ans passés à l'Université de Montréal. Il est Fellow de l'IEEE, de l'ACM et de la Société royale du Canada. Après un travail de recherches initial sur les langages de programmation et la conception de compilateurs, il a entamé vers 1974 un travail sur les protocoles de communication et a développé le domaine de « l'ingénierie de protocole », appliquant les principes de génie logiciel aux protocoles de communication.

Au début des années quatre-vingt, il a participé aux comités de normalisation ISO et UIT et a joué un rôle majeur au niveau canadien et international dans la normalisation des techniques de descriptions formelles pour les protocoles et services de communication. Il est reconnu mondialement pour son travail innovateur sur la modélisation du comportement des systèmes distribués par des machines à états finis étendus, et sur leur vérification et tests. Il a mené plusieurs collaboration de recherches avec l'industrie et, de 1989 à 1997, a dirigé la chaire de recherche industrielle Hewlett-Packard - CRSNG - CITI sur les protocoles de communication à l'Université de Montréal.

Dr. Bochmann a reçu plusieurs prix pour son travail, y compris la médaille Thomas W. Eadie de la Société royale du Canada, le prix d'excellence en recherche de l'Université d'Ottawa, et en 2005 a été reconnu en tant que « Pionnier de l'informatique au Canada » à la conférence CASCON organisée par IBM et le CNRC. Ses travaux récents ont porté sur les secteurs du génie logiciel pour applications réparties, les systèmes poste à poste, la qualité de service et la gestion de la sécurité pour applications Web, et les procédures de contrôle des réseaux optiques.

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Médaille R.A. Fessenden de l'IEEE Canada 2011

Pour contributions de pointe en électronique et optoélectronique pour les communications

M. Jamal Deen (FIEEE) est titulaire de la chaire de recherche du Canada en technologies de l'information et professeur à l'Université McMaster. Il a obtenu son BSc de l'Université du Guyana où ses réalisations lui ont mérité la Médaille du chancelier et le Prix Dr. Adler. Lors de ses études graduées à l'Université Case Western Reserve (MS et PhD), il était boursier Fulbright-LASPAU et de l'American Vacuum Society. Son travail doctoral sur la conception et la modélisation d'un nouveau spectromètre de Raman pour des mesures dynamiques de la température et l'optimisation de la combustion dans les moteurs de fusées et d'avions à réaction a été commandité et utilisé par la NASA (Cleveland, USA). Son expérience de recherches comprend environ 430 articles revus par les pairs, sept prix de meilleur article et six brevets utilisés en industrie.

Dr. Deen est considéré comme l'autorité mondiale sur la modélisation et le bruit dans les dispositifs électroniques et optoélectroniques pour les systèmes de communication. Il a transféré avec succès vers de nombreuses compagnies des maquettes de circuits et modèles technologiques puissants pour la conception de circuits de communication. Ses modèles pratiques pour les détecteurs optiques à haute performance et ses innovations expérimentales pour la prévision de la fiabilité ont contribué à la conception et à la fabrication de détecteurs photoélectriques fiables pour les communications à fibre optique.

Les pairs de Dr. Deen's l'ont nommé Fellow dans huit académies nationales et organismes professionnels incluant la Société royale du Canada, l'American Physical Society et l'Electrochemical Society. Ses autres récompenses incluent le Prix Callinan 2002 et le Prix 2011 de la division photonique et électronique de l'Electrochemical Society; un Prix de recherches Humboldt de la Fondation du même nom en Allemagne en 2006, et la médaille Eadie 2008 de la Société royale du Canada.

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2011 IEEE Canada Power Medal

For contributions to the development of medium voltage PWM variable speed drives

Frank DeWinter (FIEEE) is currently Director, Large Drives with Siemens Canada Ltd. in Edmonton. He began his career as a journeyman electrician with an apprenticeship and certificate granted by NAIT in 1976. He then completed a Bachelor of Science in Electrical Engineering in 1980 at the University of Alberta. First working at Colt Engineering in Edmonton, Frank gained a keen insight into the design and supply of large electrical projects, with a primary focus in the design and application of large drive systems and rotating machines. In 1990 he joined Rockwell Automation, and began more than a decade career as Director, Research and Development, Medium Voltage Drives.

Bringing a refreshing view to the practical aspects of High-Power Electrical and Electronic equipment, Frank has contributed for more than 30 years in the development, design, and application of large adjustable-speed drives. He trailblazed unique drive applications, most notably pioneering the application of Medium Voltage Drives, holding several patents in this area. Frank has authored, co-authored, or contributed to about 35 technical papers, assisting in expanding knowledge of how high-powered drives interact with electrical power systems and AC machines.

Frank was elected as an IEEE Fellow in 2004. For the last 25 years, he has been active in the IEEE IAS PCIC. He has held various positions, including: Transportation Subcommittee Chairs, Papers review Chairs, 1991 Toronto PCIC Publicity Chair, and the 2001 Toronto PCIC Conference Chair. Frank has also contributed to the development of IEEE standards on Harmonic Limits and Medium Voltage Drives.

2011 IEEE Canada Computer Medal

For international contributions to the theory and practice of intelligent automata

William A. Gruver (FIEEE) is President of Intelligent Robotics Corporation and Professor Emeritus of Engineering Science at Simon Fraser University. He received the PhD, MSEE, and BSEE degrees from the University of Pennsylvania and the DIC in Automatic Control Systems from Imperial College, London.

His interests are the technology and applications of distributed intelligent systems. He is an author or co-author of 230 technical papers and three books on robotics, manufacturing automation, control, and optimization.

His industrial experience includes management and technical leadership positions with GE Factory Automation Products Division in Charlottesville; GE Industrial Automation Center in Frankfurt, Germany; IRT Corporation in San Diego, Center for Robotics and Manufacturing Systems in Kentucky; and LTI Robotic Systems, a California based startup that he co-founded. He has held engineering positions at NASA Marshall Space Flight Center and DLR German Space Research Center, and faculty positions at Technical University Darmstadt, U.S. Naval Academy, University of Kentucky, and North Carolina State University.

Dr. Gruver is Fellow of the IEEE and Fellow of the Engineering Institute of Canada. He is a Past President of the IEEE Systems, Man, and Cybernetics (SMC) Society, and served as IEEE Division Director, member of the IEEE Board of Directors, and member of many IEEE and TAB level committees. He is an associate editor of major journals including *IEEE Transactions on SMC, Part A: Systems and Humans*. He co-chairs the SMC Society's Technical Committee on Distributed Intelligent Systems and was a founding officer of the IEEE Robotics and Automation Society.

Médaille d'électricité de l'IEEE Canada 2011

Pour contributions au développement des entraînements à vitesse variable PWM à moyenne tension

Frank DeWinter (FIEEE) est actuellement directeur, Large Drives chez Siemens Canada Ltd. à Edmonton. Il a débuté sa carrière en tant que compagnon électricien en obtenant un certificat d'apprentissage accordé par le NAIT en 1976. Il a alors complété un baccalauréat en science en génie électrique en 1980 à l'Université de l'Alberta. Lors de son premier travail chez Colt Engineering à Edmonton, Frank s'est bâti une expertise particulière en conception et livraison de grands projets électriques, avec un intérêt particulier en conception et mise en œuvre de grands systèmes d'entraînements et machines rotatives. En 1990 il s'est joint à Rockwell Automation et a débuté une carrière de plus d'une décennie comme directeur, recherche et développement, entraînements à moyenne tension.

Apportant une nouvelle vision aux aspects pratiques de l'équipement électrique et électronique à haute tension, Frank a contribué pendant plus de 30 ans au développement, la conception, et l'application de grands entraînements à vitesse variable. Il a pavé la voie à des applications d'entraînements originaux, innovant particulièrement dans l'application des entraînements à moyenne tension et détenant plusieurs brevets dans ce domaine. Frank est auteur, co-auteur, ou a contribué à environ 35 articles techniques, aidant à l'accroissement de la connaissance sur la façon dont les entraînements à haute tension interagissent avec les systèmes électriques et les machines à courant alternatif.

Frank a été nommé Fellow de l'IEEE en 2004. Au cours des 25 dernières années, il a été très actif au niveau de l'IAS PCIC de l'IEEE. Il a occupé diverses positions, incluant la présidence de sous-comités sur le transport, de comités de revue d'articles, du comité de publicité de PCIC Toronto 1991, et de la conférence PCIC de Toronto 2001. Frank a également contribué au développement des normes de l'IEEE sur les limites harmoniques et les entraînements à moyenne tension.

Médaille d'informatique de l'IEEE Canada 2011

Pour contributions internationales à la théorie et la pratique des automates intelligents

William A. Gruver (FIEEE) est président d'Intelligent Robotics Corporation et professeur émérite en Science du génie à l'Université Simon Fraser. Il détient un PhD, une MSEE, et un BSEE de l'Université de Pennsylvanie et un DIC en systèmes de commandes automatiques de l'Imperial College de Londres.

Ses intérêts sont en technologie et applications des systèmes intelligents répartis. Il est auteur ou co-auteur de 230 articles techniques et de trois livres sur la robotique, l'automatisation de fabrication, la commande, et l'optimisation.

Son expérience industrielle comprend des postes de leadership technique et de gestion au sein de la Division de produits d'automatisation de l'usine de GE à Charlottesville, au centre d'automatisation industrielle de GE à Francfort en Allemagne, chez IRT Corporation à San Diego, au centre pour la robotique et les systèmes de fabrication du Kentucky, et chez LTI Robotic Systems, une compagnie basée en Californie dont il est co-fondateur. Il a occupé des postes d'ingénieur au Marshall Space Flight Center de la NASA et au centre de recherches spatiales allemand DLR, et d'enseignant à l'Université technique de Darmstadt, l'U.S. Naval Academy, l'Université du Kentucky, et North Carolina State University.

Dr. Gruver est Fellow de l'IEEE et de l'Institut canadien des ingénieurs. Il a été président de l'IEEE Systems, Man, and Cybernetics Society (SMC), et directeur de division de l'IEEE, membre du conseil d'administration de l'IEEE, et membre de plusieurs comités de l'IEEE et de TAB. Il est éditeur associé de journaux importants, nottament *l'IEEE Transactions on SMC, Part A: Systems and Humans*. Il est co-président du comité technique de la SMC sur les systèmes intelligents répartis et est officier fondateur de l'IEEE Robotics and Automation Society.

2011 IEEE Canada Outstanding Engineering Educator Award

For contributions to the internationalization of engineering education via exchange programs and systems

Keith W. Hipel (FIEEE) is a native of Waterloo and a descendent of pioneers who immigrated to Southern Ontario in the mid-nineteenth century from Alsace-Lorraine. He is University Professor of Systems Design Engineering at the University of Waterloo, where he is Coordinator of the Conflict Analysis Group. Keith is Senior Fellow at the Centre for International Governance Innovation and recently served a two-year term as Vice President of the Canadian Academy of Sciences.

Keith thoroughly enjoys mentoring students and is a recipient of the Distinguished Teacher Award and the Award of Excellence in Graduate Supervision. He is the Canadian Founder and Director of exchange programs with Tottori University, Kyoto University and the Tokyo Institute of Technology in Japan, in which 200 students from Waterloo and Japan have now participated. In 1996, Keith was elected Fellow of IEEE for contributions to the development of Systems Design Engineering as an educational discipline. His major research interests are the development and application of conflict resolution, multiple objective decision making and time series analysis techniques from a systems engineering perspective. The main application areas of these decision technologies are water resources management, hydrology, environmental engineering and sustainable development.

Keith is the recipient of 31 major awards including the IEEE Systems, Man and Cybernetics Norbert Wiener Award, Docteur Honoris Causa from École Centrale de Lille, Icko Iben Award and W.R. Boggess Award from the American Water Resources Association, and the 2010 Ontario Professional Engineers *Engineering Medal for Research and Development*. He is a Fellow of IEEE, EIC, Canadian Academy of Engineering, Royal Society of Canada, International Council on Systems Engineering and the American Water Resources Association.

2011 IEEE Canada Robert H. Tanner Industry Leadership Award

For successful leadership in power utilities

Colin Clark (SMIEEE) is Managing Partner & Chief Technical Officer of the Power and Utilities Group of Brookfield Asset Management Inc., where he is the senior executive providing oversight of all engineering and technical affairs of the group. He was formerly Executive Vice President & Chief Technical Officer of Brookfield Renewable Power Inc., Senior Vice-President, Operations of Brookfield Power, and President & CEO of Great Lakes Power Limited and Lake Superior Power. Mr. Clark was previously Superintendent of Stations & Metering at Ottawa Hydro and Engineer of Gananoque Light & Power Ltd.

Mr. Clark is a graduate in Electrical Engineering from Queen's University at Kingston, and a Licensed Professional Engineer in Ontario and British Columbia. He has more than 30 years of experience as an engineer and executive in all areas of electric power utilities operations. Mr. Clark has also had responsibility for the design, construction, and evaluation of many electric power generation, transmission, and distribution projects.

Mr. Clark is a founder and Past-Chair of the Board of Directors of the Canadian Hydropower Association, Chair of the Generation Council and former Director of the Canadian Electricity Association, a Director of the International Hydropower Association, a founder and former Co- Chair of the Ontario Water Power Association, a former Director of the Association of Power Producers of Ontario, and a member of many other industry associations and advisory bodies. He is the author or co-author of more than 30 professional papers, articles, presentations, and lectures.

Prix d'excellence en enseignement du génie de l'IEEE Canada 2011

Pour contributions à l'internationalisation de l'enseignement en génie par l'intermédiaire des programmes d'échanges

Keith W. Hipel (FIEEE) est natif de Waterloo et descend des pionniers qui ont immigré vers le sud de l'Ontario au milieu du 19e siècle en provenance de l'Alsace-Lorraine. Il est professeur en génie de conception de systèmes à l'Université de Waterloo où il coordonne le Groupe d'analyse de conflits. Keith est Senior Fellow au Centre pour l'innovation dans la gouvernance internationale et a récemment servi deux ans comme vice-président de l'Académie canadienne des sciences.

Keith apprécie particulièrement faire du mentorat auprès des étudiants et est récipiendaire du Distinguished Teacher Award et de l'Award of Excellence in Graduate Supervision. Il est le fondateur et directeur canadien des programmes d'échanges avec l'Université de Tottori, l'Université de Kyoto et l'Institut de Technologie de Tokyo au Japon, auxquels 200 étudiants de Waterloo et du Japon ont participé jusqu'à présent. En 1996, Keith a été nommé Fellow de l'IEEE pour sa contribution au développement du génie de la conception de systèmes en tant que discipline pédagogique. Ses principaux intérêts de recherches sont le développement et l'application de résolution de conflits, la prise de décision à objectifs multiples et les techniques d'analyse de séries chronologiques selon une perspective d'ingéniérie de systèmes. Les principaux domaines d'application de ces techniques de décision sont la gestion de ressources en eau, l'hydrologie, le génie environnemental et le développement durable.

Keith est récipiendaire de 31 prix importants dont le Prix Norbert Wiener de l'IEEE Systems, Man and Cybernetics Society, un doctorat honoris causa de l'École centrale de Lille, le Prix Icko Iben et le Prix W.R. Boggess de l'American Water Resources Association, et la Médaille pour la recherche et développement en ingénierie 2010 d'Ontario Professional Engineers. Il est Fellow de l'IEEE, de l'Institut canadien des ingénieurs, de l'Académie canadienne du génie, de la Société royale du Canada, de l'International Council on Systems Engineering et de l'American Water Resources Association.

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Prix d'excellence en leadership industriel Robert H. Tanner de l'IEEE Canada 2011

Pour son leadership au sein des compagnies d'électricité

Colin Clark (SMIEEE) est associé directeur général et directeur de la technologie du groupe Électricité et services publics de Brookfield Asset Management Inc., où il supervise l'ingénierie et les questions techniques du groupe. Il a été vice-président exécutif et diecteur de la technologie chez Brookfield Renewable Power Inc., vice-président principal, opérations chez Brookfield Power, et président et chef de la direction de Great Lakes Power Limited and Lake Superior Power. M. Clark a aussi été surintendant de Stations & Metering chez Ottawa Hydro et ingénieur chez Gananoque Light & Power Ltd.

M. Clark détient un diplôme en génie électrique de l'Université Queen à Kingston, et est ingénieur breveté en Ontario et en Colombie-Britannique. Il possède plus de 30 ans d'expérience en tant qu'ingénieur et directeur dans tous les aspects d'opérations de centrales électriques. M. Clark a également été responsable de la conception, la construction, et l'évaluation de nombreux projets de production, transmission, et distribution d'électricité.

M. Clark est fondateur et ex-président du conseil d'administration de l'Association canadienne de l'hydroélectricité, président du Conseil de la production et ex-directeur de l'Association canadienne de l'électricité, directeur de l'Association internationale d'hydroélectricité, fondateur et ex-coprésident de l'Ontario Water Power Association, ex-directeur de l'Association des producteurs d'électricité de l'Ontario, et membre de plusieurs autres associations industrielles et organismes consultatifs. Il est auteur ou co-auteur de plus de 30 communications, articles, présentations, et exposés professionnels.

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2011 IEEE Canada W.S. Read Outstanding Service Award

For inspirational, distinguished and sustained volunteer leadership in IEEE Canada

Ashfaq (Kash) Husain (SMIEEE) is a graduate of Mount Allison University and Dalhousie University, where he received a BEng in Electrical Engineering in 1976. He is currently employed with Dillon Consulting Ltd., advising on Power Systems for large industries.

Kash has more than 22 years of continuous volunteer service with IEEE Canada. In 1988 he joined the Canadian Atlantic Section, became their Secretary, and then in 1993, their Chair. When the family moved to London in 1994, he joined the Section's ExCom committee, serving as representative at the Region level, then Treasurer and eventually was elected as Chair. In recognition of his efforts to rejuvenate the Section, Kash received the MB Broughton Central Canada Award. Kash is still their treasurer.

In April 2000, Kash went on disability leave as a result of his loss of eyesight. He has Retinitis Pigmentosa, a degenerative disease of the retina — Kash is legally blind! Rather than retreat from society, Kash has done the opposite. He has become a full-time volunteer not just with the IEEE but with several other organizations that provide support and services to persons with disabilities.

His volunteer work with the IEEE continues to grow, more recently in conference organization. He has served as treasurer of CCECE/CCGEI in 2001, 2004 and 2008. This experience led him to accept the Chair of IEEE Canada's Conference Advisory Committee (CONAC), a position he held for the three-year term. In his current role as Chair, Central Canada Area, Kash continues to promote the importance of volunteerism with the IEEE.

2011 IEEE Canada J.J. Archambault Eastern Canada Merit Award

For contributions in promoting collaboration between eastern area sections of IEEE Canada

Amir G. Aghdam (SMIEEE) is currently Associate Professor in the Department of Electrical and Computer Engineering at Concordia University, receiving his Ph.D. from the University of Toronto in 2000. Prior to joining Concordia, he worked as a development engineer at Voyan Technology, Santa Clara, California.

Joining Montreal Section in 2002, Amir's enthusiasm helped quickly establish him as an adept organizer. He was Founding Chair of the Control Systems Chapter (2004-2007), and Co-founder of the joint Systems, Man & Cybernetics / Aerospace & Electronics Systems Chapter (2005). He was elected Section Chair in 2005, serving two consecutive one-year terms. Elected Canada East Area chair in 2007, one of his first achievements was to build support for elevating the Electrical Power and Energy Conference (EPEC) – then a flourishing Canada East event largely organized by Ottawa Section – to full sponsorship by IEEE Canada. He then helped forge a team of Montreal and Ottawa Section volunteers to deliver the first of many repeated successes of this now internationally-attended conference. During the rest of his tenure, Amir continued to be a driving force in multi-section delivery of a host of other IEEE conferences, on steering committees and as Technical Program Co-chair, Local Arrangements Chair, and Awards Co-chair. He also organized more than 100 invited talks in Montreal and other cities in Eastern Canada.

Amir has published more than 100 refereed technical papers, books and book chapters, and holds two patents. In 2009, he received an IEEE MGA Achievement Award for promoting section collaboration. He is a member of Professional Engineers Ontario, Editor-in-Chief of *IEEE Canadian Review*, and General Conference Chair of 2012 CCECE/CCGÉI.

Prix d'excellence de service W.S. Read de l'IEEE Canada 2011

Pour son leadership bénévole inspirant, remarquable et assidu envers l'IEEE Canada

Ashfaq (Kash) Husain (SMIEEE) est diplômé de l'Université Mount Allison et de l'Université Dalhousie, où il a obtenu un BEng en génie électrique en 1976. Il est actuellement à l'emploi de Dillon Consulting Ltd, où il est conseiller en systèmes électriques pour la grande industrie.

Kash a offert plus de 22 ans de service bénévole soutenu à l'IEEE Canada. En 1988 il s'est joint à la section Canada Atlantique, en est devenu secrétaire, puis président en 1993. Lorsque sa famille a déménagé à London en 1994, il s'est joint au comité exécutif de la section, servant de représentant au niveau de la Région; il était alors trésorier et par la suite a été élu président. En reconnaissance de ses efforts pour la revitalisation de la section, Kash a reçu le prix M.B. Broughton du Centre du Canada. Kash est toujours leur trésorier.

En avril 2000, Kash est parti en congé d'invalidité en raison de sa perte de la vue. Il souffrait d'une rétinite pigmentaire, une maladie dégénérative de la rétine - Kash est aveugle au sens légal! Plutôt que de se retirer de la société, Kash a fait l'opposé. Il est devenu un volontaire à plein temps, pas simplement au niveau de l'IEEE, mais au sein de plusieurs autres organismes qui fournissent du support et des services aux personnes souffrant d'incapacités.

Son bénévolat au sein de l'IEEE continue de croître, et plus récemment au niveau de l'organisation de conférences. Il a été trésorier de la CCECE/CCGÉI en 2001, 2004 et 2008. Cette expérience l'a conduit à accepter la présidence du Comité consultatif des conférences de l'IEEE Canada (CCC), une position qu'il a occupée pendant un terme de trois ans. Dans son rôle actuel de président, Zone Canada Central, Kash continue de promouvoir l'importance du bénévolat au sein de l'IEEE

Prix d'excellence J.J. Archambault de l'est du Canada de l'IEEE Canada 2011

Pour contributions à la promotion de la collaboration entre les sections de la Zone est de l'IEEE Canada

Amir G. Aghdam (SMIEEE) est actuellement professeur agrégé au département de génie électrique et informatique de l'Université Concordia, et a obtenu son Ph.D. de l'Université de Toronto en 2000. Avant de se joindre à Concordia, il a travaillé en tant qu'ingénieur de développement chez Voyan Technology à Santa Clara, Californie.

Joignant la section de Montréal en 2002, l'enthousiasme d'Amir l'a rapidement aidé à s'imposer comme organisateur hors pair. Il a été président fondateur du chapitre Control Systems (2004-2007), et co-fondateur du chapitre conjoint Systems, Man & Cybernetics / Aerospace & Electronics Systems (2005). Il a été élu président de section en 2005, servant deux termes consécutifs d'un an. Nommé président de la Zone est du Canada en 2007, une de ses premières réalisations a été de mobiliser les appuis pour que la Conférence sur l'énergie électrique (CEE-EPEC) - alors un événement florissant de l'est du Canada en grande partie organisé par la section d'Ottawa - soit parrainé directement par IEEE Canada. Il a alors aidé à constituer une équipe de bénévoles des sections de Montréal et Ottawa pour livrer le premier d'une série de succès pour cette conférence maintenant fréquentée internationalement. Pendant le reste de son mandat, Amir a continué d'être l'élément moteur dans la livraison multi-sections d'une foule d'autres conférences de l'IEEE, dans des comités directeurs et en tant que co-président technique de programmes, président des arrangements locaux, et co-président en charge des prix. Il a également organisé plus de 100 exposés sur invitation à Montréal et dans d'autres villes de l'est du Canada.

Amir a publié plus de 100 articles techniques révisés, livres et chapitres de livre, et détient deux brevets. En 2009, il a reçu le MGA Achievement Award de l'IEEE pour avoir encouragé la collaboration entre les sections. Il est membre de l'Association des ingénieurs professionnels de l'Ontario, rédacteur-en-chef de *la Revue canadienne de l'IEEE,* et président de la conférence CCECE/CCGÉI 2012.

sponsored by IEEE Canadian Foundation / commandité par Fondation canadienne de l'IEEE

2011 IEEE Canada M.B. Broughton Central Canada Merit Award

For outstanding services to the growth and sustainability of the London section

Maike Luiken (SMIEEE) is Dean, Applied Research and Sustainable Development at Lambton College in Sarnia. She most previously served as Vice-President – Research Alliances for The National Capital Institute of Telecommunications in Ottawa. Maike obtained her Staatsexamen in Mathematics and Physics from the Technical University in Braunschweig, Germany (1979) and her Ph.D. in Physics from the University of Waterloo (1982). With experience in both the public and private sectors, a notable forte is connecting industry, government agencies and academic researchers in advanced technology projects.

A very active IEEE Canada volunteer for more than 10 years, Maike has applied her skills in partnership- and network-building to membership outreach in two sections. While in Ottawa, she engaged local and international presenters from academia, industry and government laboratories in a series of more than 20 packed workshops. Then as London Section Chair, initiatives such as the Sustainability Seminar series (more than 50 events) have linked the academic community, industry, the public and local chapters of ISA, PEO and OACETT. More recently, she spearheaded the formation in London of a PES Chapter, and WIE and GOLD Affinity Groups.

During Maike's tenure as Chair in 2005, Ottawa Section was honoured with the RAB Outstanding Large Section Award. Subsequently under her leadership, London Section received the IEEE Canada Exemplary Small Section Award in 2009. Maike is a Fellow of EIC, and a Board member of the IEEE Canadian Foundation. Other positions include Unmanned Systems Canada Board (2003-10), the Sarnia Lambton Chamber of Commerce Board (2008-11) and Bluewater Sustainability Initiative Steering Committee (2006-11).

2011 IEEE Canada E.F. Glass Western Canada Merit Award

In recognition of service to the power industry, and contributions to the IEEE milestone program

Lindsay Ingram (LSMIEEE) is a former Director of the System Planning Division, Manitoba Hydro, where he worked for 33 years. He retired in 1984 to become Interim Director of the High Voltage DC Research Centre in Winnipeg, providing leadership in its fledgling stages. During his tenure the Centre embarked upon many key initiatives, including work on a real-time digital simulator that became a success internationally.

Since then, Lindsay has been no less busy as a volunteer, avidly promoting the history of electrification in the province, at the same time boosting awareness of IEEE both locally and internationally. He played a central role in the formation and development of the Manitoba Electrical Museum and Education Centre, which documents load growth back to the 1880s. Sponsored by Manitoba Hydro, it opened to the public in 2001. Winnipeg Section's Life Member Chapter is the latest beneficiary of his passion. Vice-Chair since 2004, Lindsay's enthusiasm inspired others to join in the careful research that led to two successful Milestone nominations: The Nelson River High Voltage Direct Current (HVDC) Transmission System, dedicated in 2005, and The Pinawa Hydroelectric Power Plant, dedicated in 2008.

Lindsay's talent as a writer has seen several historical articles published in the *IEEE Power and Energy* magazine, as well as engaging accounts of the construction and significance of the Nelson River and Pinawa projects published in the *IEEE Canadian Review*. In addition to his active membership in IEEE, his broader engineering activities include Life Membership in the EIC, CSSE and APEGM.

Prix d'excellence M.B. Broughton du centre du Canada de l'IEEE Canada 2011

Pour services exceptionnels à la croissance et à la pérennité de la section de London

Maike Luiken (SMIEEE) est doyenne, Recherche appliquée et développement durable au Collège Lambton de Sarnia. Elle a servi précédemment comme vice-présidente aux partenariats de recherche pour l'Institut de télécommunications de la capitale nationale à Ottawa. Maike a obtenu son Staatsexamen en mathématiques et physique de l'Université technique de Brunswick en Allemagne (1979) et son Ph.D. en physique de l'Université de Waterloo (1982). Hormis son expérience des secteurs publics et privés, un de ses talents principaux est le réseautage avec l'industrie, les agences gouvernementaux et les chercheurs académiques pour des projets de technologie de pointe.

Bénévole très active au sein de l'IEEE Canada depuis plus de 10 ans, Maike a mis en œuvre ses talents en partenariats et réseautage pour le recrutement des membres dans deux sections. Lorsqu'elle était à Ottawa, elle a engagé des présentateurs locaux et internationaux venant du milieu universitaire, de l'industrie et des laboratoires gouvernementaux dans une série de plus de 20 ateliers tenus à guichets fermés. Alors qu'elle était présidente de la section de London, elle a lancé plusieurs initiatives telles une série de séminaires sur le développement durable (plus de 50 événements) qui ont mis en relation la communauté académique, l'industrie, le public et les chapitres locaux de l'ISA, du PEO et de l'OACETT. Plus récemment, elle organisé la formation à London d'un chapitre PES et de groupes d'affinité WIE et GOLD.

Pendant la présidence de Maike en 2005, la section d'Ottawa a reçu le prix de Grande section exceptionnelle du RAB. Ensuite, sous sa direction, la section de London a reçu le prix de Petite section exemplaire de l'IEEE Canada en 2009. Maike est Fellow de l'ICI et membre du conseil de la Fondation canadienne de l'IEEE. Elle a occupé d'autres postes incluant au Conseil de Systèmes télécommandés Canada (2003-10), au C.A. de la chambre de commerce de Sarnia Lambton (2008-11) et au Comité directeur d'initiatives en développement durable Bluewater (2006-11).

Prix d'excellence E.F. Glass de l'ouest du Canada de l'IEEE Canada 2011

En reconnaissance de services rendus envers l'industrie électrique, et de contributions au programme des milestones de l'IEEE

Lindsay Ingram (LSMIEEE) est ex-directeur de la Division de planification de systèmes chez Manitoba Hydro où il a travaillé pendant 33 ans. Il a pris sa retraite en 1984 pour devenir directeur intérimaire du High Voltage DC Research Centre à Winnipeg, procurant le leadership nécessaire à son démarrage. Au cours de son mandat le Centre s'est engagé dans plusieurs initiatives importantes, incluant un projet de simulateur numérique en temps réel qui est devenu un succès international.

Depuis lors, Lindsay n'a pas été moins occupé en tant que bénévole, promouvant l'histoire de l'électrification dans sa province et augmentant la visibilité de l'IEEE localement et internationalement. Il a joué un rôle central dans l'établissement et le développement du Centre d'éducation et musée de l'électricité du Manitoba, qui documente l'accroissement de la demande électrique depuis 1880. Commandité par Manitoba Hydro, il a été ouvert au public en 2001. Le chapitre Membres à vie de la section de Winnipeg est le plus récent bénéficiaire de sa passion; il y est vice-président depuis 2004. L'enthousiasme de Lindsay a inspiré plusieurs autres à contribuer à la recherche soigneuse qui a mené à l'obtention de deux *Milestones* : Le Système de transmission à courant continu à haute tension (HVDC) de Nelson River, dédié en 2005, et la Centrale hydroélectrique de Pinawa, dédiée en 2008.

Le talent de Lindsay en tant qu'auteur a été récompensé par la publication de plusieurs articles historiques dans le magazine *Power and Energy de l'IEEE,* ainsi que de chroniques prenantes sur la construction et l'importance des projets Nelson River et Pinawa dans *la Revue canadienne de l'IEEE*. En plus de son implication active dans l'IEEE, ses activités professionnelles en tant qu'ingénieur incluent Membre à vie de l'ICI, la SCEE et l'APEGM.

IEEE Canada members elected as 2011 IEEE Fellows

Pierre Berini (FIEEE)—Ottawa, Ontario
For contributions to surface plasmon photonics

Voicu Zamfir Groza (FIEEE)—Ottawa, Ontario
For contributions to floating-point analog-to-digital conversion

Natalia K. Nikolova-Zimmerman (FIEEE)—Hamilton, Ontario
For contributions to computer-aided analysis of microwave systems

M. Tamer Ozsu (FIEEE)—Waterloo, Ontario
For contributions to distributed data management and multimedia database systems

Catherine P. Rosenberg (FIEEE)—Waterloo, Ontario
For contributions to resource management in wireless and satellite networks

Edward H. Sargent (FIEEE)—Toronto, Ontario
For contributions to colloidal quantum dots optoelectronic devices

Chinthananda Tellambura (FIEEE)—Edmonton, Alberta
For contributions to physical layer wireless communication theory

Lei Wang (FIEEE)—Surrey, British Columbia
For contributions to power system stability

Xiaolin Wu (FIEEE)—Hamilton, Ontario
For contributions to image coding, communication and processing

IEEE William E. Newell Power Electronics Award

Praveen Jain (FIEEE)—Kingston, Ontario
For advancements in the theory and practice of high-frequency power conversion systems.

Membres de l'IEEE Canada élus Fellows de l'IEEE 2011

Pierre Berini (FIEEE)—Ottawa, Ontario
Pour contributions à la photonique de plasmon de surface

Voicu Zamfir Groza (FIEEE)—Ottawa, Ontario
Pour contributions à la conversion analogique-vers-numérique à point-flottant

Natalia K. Nikolova-Zimmerman (FIEEE)—Hamilton, Ontario
Pour contributions à l'analyse assistée par ordinateur des systèmes micro-onde

M. Tamer Ozsu (FIEEE)—Waterloo, Ontario
Pour contributions à la gestion de données distribuées et systèmes de base de données multimédia

Catherine P. Rosenberg (FIEEE)—Waterloo, Ontario
Pour contributions à la gestion de ressources dans les réseaux sans-fil et satellite

Edward H. Sargent (FIEEE)—Toronto, Ontario
Pour contributions aux dispositifs optoélectroniques à points quantiques colloïdaux

Chinthananda Tellambura (FIEEE)—Edmonton, Alberta
Pour contributions à la théorie de communication sans-fil de la couche physique

Lei Wang (FIEEE)—Surrey, Colombie-Britannique
Pour contributions à la stabilité d'un système de puissance

Xiaolin Wu (FIEEE)—Hamilton, Ontario
Pour contributions au codage, à la communication et au traitement d'image

Prix d'électronique de puissance William E. Newell de l'IEEE

Praveen Jain (FIEEE)—Kingston, Ontario
Pour avancements dans le domaine de la théorie et de la pratique de systèmes de conversion de puissance haute fréquence.

IEEE Canada members elected as 2011 EIC Fellows

André Ivanov (FIEEE)—Vancouver, British Columbia
For outstanding contributions to the design and testing of very large-scale integrated (VLSI) circuits. His achievements have led to many new and advanced technologies that have greatly impacted the shape of VLSI test technology processes worldwide and affected the entire semiconductor industry.

Jin Jiang (SMIEEE)—London, Ontario
For his contributions to the fields of fault-tolerant control systems, and control and instrumentation systems for nuclear power plants. He has made exceptional contributions to research and education and services to the engineering profession and society.

Raman Kashyap (SMIEEE)—Montréal, Québec
For his major contributions to the field of photonics through novel applications and development of the technology of Fiber Bragg Gratings (FBGs), and novel optical devices.

Xuemin (Sherman) Shen (FIEEE)—Waterloo, Ontario
For his contributions to the areas of network resource management and information security for wireless communications. His research results have been highly influential in the wireless networking research community, and helped set directions for others.

EIC Medalist

Sir John Kennedy Medal

Gordon Slemon (LFIEEE)—Toronto, Ontario
For his outstanding contributions to the analysis, design and development of electric machines and controlled drive systems. He has served extensively as an engineering consultant to Canadian industrial organizations.

Membres de l'IEEE Canada élus Fellows de l'ICI 2011

André Ivanov (FIEEE)—Vancouver, Colombie-Britannique
Pour sa contribution exceptionnelle à la conception et aux tests de circuits intégrés à très grande échelle (VLSI). Ses réalisations ont contribué à générer plusieurs technologies novatrices qui ont eu un impact considérable à travers le monde sur les processus de tests VLSI et ont profité à l'industrie des semi-conducteurs.

Jin Jiang (SMIEEE)—London, Ontario
Pour sa contribution au domaine des systèmes de commandes tolérants aux pannes, et aux systèmes de commandes et d'instrumentation pour centrales nucléaires. Il a fourni un apport exceptionnel à la recherche et à l'enseignement et de grands services à la profession et à la société.

Raman Kashyap (SMIEEE)—Montréal, Québec
Pour sa contribution majeure au domaine de la photonique par des applications novatrices et le développement de la technologie des réseaux de Bragg sur fibres (FBGs), et de nouveaux dispositifs optiques.

Xuemin (Sherman) Shen (FIEEE)—Waterloo, Ontario
Pour sa contribution au domaine de la gestion des ressources de réseaux et de la sécurité de l'information pour les communications sans fils. Ses résultats de recherche ont montré la voie et fortement influencé la communauté de recherche sur les réseaux sans fils.

Médaillé de l'ICI

Médaille Sir John Kennedy

Gordon Slemon (LFIEEE)—Toronto, Ontario
Pour sa contribution exceptionnelle à l'analyse, la conception et au développement de machines électriques et systèmes d'entraînement asservis. Il a beaucoup œuvré en tant qu'ingénieur conseil auprès d'organisations industrielles canadiennes.

Translation volunteers / *Traducteurs bénévoles*
Christian Pépin, Eric Holdrinet

Medal photos courtesy of Gary Gerovac Photography
Photos de médailles courtoisie de Gary Gerovac Photography

IEEE EPEC 2011
Electrical Power and Energy Conference
Advanced Technologies for Emerging Power Systems

October 3—5, 2011, Winnipeg, MB, Canada

The annual Electrical Power and Energy Conference (EPEC 2011) will take place in Winnipeg, Manitoba, Canada, from October 3 to 5, 2011. Located in the center of Canada, Winnipeg is a culturally diverse, creative and cosmopolitan city with a warm, welcoming spirit. The objective of EPEC 2011 is to provide a forum for experts in Electrical Power and Energy to disseminate their recent research outcomes and exchange views on future research directions. This year we are working with The Energy Services Alliance of Manitoba to bring in renowned experts to give keynote speeches related to the Smart Grid. Bring your family with your research findings to EPEC2011, enjoy our programs and appreciate the history of Winnipeg.

http://www.ieee.ca/epec11/

Topics:

The topics of interest relate to electric power and energy, and especially papers with the following focus:

HVDC & FACTS
- Project developments, including voltage source converter (VSC) dc transmission
- Application for renewable energy systems
- Advances in study and analysis tools
- Power quality issues and solutions
- HVdc supergrids

Wind Power & Solar
- Challenges with integration of variable generation
- New technology development

Smart Grid
- Smart Grid concepts and pilot projects
- Electric vehicles (grid impacts, standards)
- Advanced metering infrastructure
- On-line dynamic security assessment
- Smart sensors including dynamic equipment rating and condition assessment methods
- Applications of phasor measurement units
- Energy Storage
- Distribution system automation and control

Computational Methods
- Computational methods in power system planning, operation and control
- Probabilistic planning and risk analysis
- Reliability centered maintenance and asset management

Advanced Technology Developments
- Fault current limiters
- Energy conservation and efficiency

Exhibitions:

There will be an exhibition site at the conference. Companies and institutions who are interested are encouraged to contact the exhibition chair for further information.

For more information, contact:

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IEEE Canada

Patentability of "Business Methods"
Recent developments provide better protection for engineers' innovations

by Alexandre Abecassis

Recent developments in patent law and jurisprudence have rendered possible or confirmed the possibility of obtaining patent protection for innovations related to "business methods" in many jurisdictions. In particular, the patentability of "business methods" has been confirmed by jurisprudence in both the United States and Canada.

Patentability of "business methods" in the U.S.

In the United States, the recent landmark case is the famous "Bilski" case. The decision was rendered on June 28, 2010 by the U.S. Supreme Court. What was at stake here was the patentability of a "business method" in which a consumer pays a fixed fee for energy regardless of actual consumption, in peak months such as in winter in cold climate areas and in summer in hot climate areas. The consumer therefore avoids the risk of a high energy bill if the weather is particularly inclement. In order to determine the fixed fee, predictions are made based on historical data. The consumer would pay slightly more than the average predicted cost for the period of time. The supplier would receive slightly less than the average predicted cost allowing the middle-man to make a profit on each sale. The consumer would benefit from fixed-price billing for the duration of the period, thereby allowing proper budgeting and energy bills void of any surprises. The energy company would benefit from a guaranteed sale of its energy for the period and would appreciate the constant client base. The middle-man would make a profit based on the difference between the supplier rate and the consumer rate and could improve this profit by making better predictions and maximizing the difference between the average predicted cost and the consumer and supplier prices.

Sadly for the applicant, the method claims of the patent application were rejected by the U.S. Supreme Court because they were considered to pertain to abstract ideas. In fact, the Supreme Court mentioned that the applicant wanted to patent the concept of hedging risk and the application of that concept to energy markets and that this was an abstract idea. That being said, the Supreme Court mentioned also that some claimed inventions designed for the business world could be patentable. This is the key part of the decision for the sake of this article.

The "business method" claim would need to meet the Patent Act's requirements that the invention be novel, non-obvious and fully and particularly described, in addition to not being directed to abstract ideas.

Patentability of "business methods" in Canada

A bit later in Canada, on October 14, 2010, the Federal Court released its decision in the appeal of a decision by the Commissioner of Patents to deny a patent to Amazon.com for a business method. The decision of the Court considered whether a "business method" is patentable under Canadian law. The patent application was for a "Method And System For Placing A Purchase Order Via A Communication Network". The claimed invention has uses in Internet shopping, where it enables a customer to purchase an item with a "single click". This is the famous "One-click patent". In 2004, a Canadian patent Examiner rejected the patent application on the basis of both obviousness and non-patentable subject matter. Amazon.com subsequently appealed the Examiner's rejection. The Commissioner of Patents ultimately accepted the findings of a Patent Review Panel, and overturned the Examiner's rejection on the basis of obviousness, but rejected the claims of the application as non-patentable subject matter.

The decision basically concluded that there was no basis for the Commissioner's assumption that there is a "tradition" of excluding "business methods" from patentability in Canada and concluded that a "business method" can be patented in Canada in appropriate circumstances. It is worth noting that an appeal has been filed for this decision by the Commissioner and that the decision should be rendered in the coming months.

Engineers should consider patenting "business methods" to better protect their innovations

In view of those two decisions, it may be worth keeping in mind the opportunity of protecting "business methods" associated with a new design. In fact, new engineering designs often permit new and non-obvious ways of conducting business. Those new and non-obvious ways of conducting business may show great advantages over prior art ways of conducting business. Protecting those new ways of carrying business may be pertinent so that if new and non-obvious designs are made later on by a third party, say a competitor for instance, those new "business methods" will enjoy the benefit of patent protection and the competitor will have to think twice prior using his or her innovation to do the patent pending or patented "business method."

Getting patent protection for "business methods" associated with a new design may also give additional benefits to business owners. In fact, in the case of mergers or acquisitions, having patent protection may add a substantial value to the company owning it. In some cases, it will be possible to license the technology associated with the new design. In such cases, having patent protection will definitely give an edge to the licensor by ensuring the licensee that patent protection is available and third party are deterred from using the technology associated with the new design. Moreover, in some instances, a company may discover at some point that there is an infringement of a patent owned by a third party. In such cases, the matter may be solved by granting a license on a patent owned by the company to the third party, provided of course that the company has one. This is a great way to avoid a costly and painful patent litigation.

When creating new designs, engineers should therefore ask themselves what advantages their new designs bring over the prior art with respect to conducting business and assess whether those should be protected or not using a patent. A patent agent may be of great help in order to make a sound decision.

About the Author

Alexandre Abecassis, Eng., SMIEEE, is partner of the firm Fasken Martineau DuMoulin LLP. He practices in intellectual property and more specifically in the area of patents. As a registered Canadian and United States Patent Agent, he finds creative and proactive solutions that maximize the value of his clients' innovations. Alexandre has developed a practice mainly focused on the high-tech sector with innovations in electronics, software, imaging and telecommunication. He has also developed a solid expertise for protecting business methods as well as innovations in the aerospace industry. Alexandre is an Associate Editor of the *IEEE Canadian Review*, contributing the "Newslog" department.

N.Ed.

This issue of the *IEEE Canadian Review* marks Mr. Abecassis' 30th as an Associate Editor, a milestone we heartily congratulate him for. His regular "Newslog" department summarizing announcements of new technologies and contracts continues to be a reader favourite. The department actually slightly pre-dates him, however, having first appeared in issue #32, under the direction of then Editor-in-Chief Vijay Sood, with Mr. Abecassis joining the publication for issue #37.

What makes a good magazine department? A topic of relevance across all areas of technical specialization, and an author with the expertise and willingness to commit to writing it on a regular basis. If you have an idea for a department, please share it by contacting aghdam@ieee.org.

We often are asked about a "View from the East" department to complement Terry Malkison's efforts highlighting developments in Western Canada. Any takers?

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IEEE has selected Certain Lloyd's Underwriters for this insurance program. Alternative insurance products may be available in the insurance marketplace. R&Q Risk Services Canada Limited is providing this single insurer option on behalf of IEEE. This coverage is available to residents of Canada through R&Q Risk Services Canada Limited. Scott Saddington, Chief Executive Officer of R&Q Risk Services Canada Limited, acts as an agent with respect to residents of Canada. Marketing is developed by Marsh U.S. Consumer, a service of Seabury & Smith, Inc. IEEE prohibits discrimination, harassment and bullying. For more information, visit www.ieee.org/web/aboutus/whatis/policies/p9-26.html.

IEEE Canadian Foundation
Fondation Canadienne de l'IEEE

2010 Honour Roll of Donors

From the President

I would like to acknowledge and thank those of you who have generously given to the IEEE Canadian Foundation in 2010.

Your gifts have enabled our foundation to continue to enhance the learning experience of engineering students through our programs of McNaughton Centres and Scholarships.

In addition, you have enabled students and other recipients to benefit others through the co-funding of special projects that are in-house (IEEE) or outreach programs that develop engineering or science skills at pre-university levels. All our Special Grant recipients are required to submit project reports that are saved and many of these are highlighted on our website as "Success Stories" and also in this magazine. Increasingly, we see the application of technology for the benefit of humanity in these projects.

Our General Fund is crucial to our ability to operate each and every year, so please continue with your undirected donations and keep our base strong.

Our Endowed Funds enable the foundation to offer a wide range of peer recognition awards, scholarships and prizes. If there are special circumstances, please consider a personal or corporate directed donation to endow an IEEE Canada award or create a new award of your choosing. IEEE Canada major awards such as the Electric Power, Computer, and Outstanding Engineer awards are available for medal endowment.

I am very appreciative of your past support and earnestly urge you to continue to do so and increase your contributions where possible. If you have not yet made a donation, I urge you to please do so—we could do so much more with your financial support.

If there are ways you feel we can do better, please contact me—I welcome your suggestions.

I close by thanking the many IEEE volunteers in Canada that give of their time, talents, and energies in the all-volunteer effort which is the IEEE Canadian Foundation.

Yours sincerely,

Robert T.H. (Bob) Alden
President,
IEEE Canadian Foundation

IEEE Canadian Foundation
Robert T.H. (Bob) Alden, President
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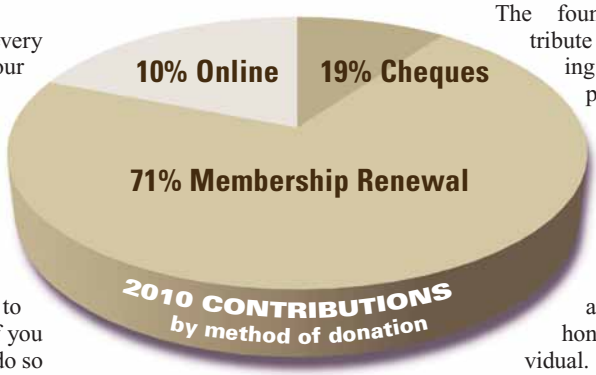
2010 Year in Review

— Donations from individuals in 2010 increased to $19,927 from $16,124 in 2009. The corresponding increase in the number of donors was from 252 to 334. Of the 334, 16 were from outside Canada. The pie chart shows the distribution of contributions between the IEEE membership renewal process (in US funds), our own Canadian online donation service (with receipts by return email), and cheques mailed to our treasurer (popular with some of our higher contribution donors). The foundation received a directed donation from the IEEE Foundation of $20,000 to endow the IEEE Canada R.H. Tanner Industry Leadership Medal, and about $22,000 as a directed donation from the Vancouver Section to establish the Vancouver Section Scholarship Fund, which can receive donations via our website.

The foundation created a Canadian Life Members Fund (CLMF) and a method whereby Canadian life members can receive a life member pin for a minimum donation of $60, or an IEEE milestone pewter coaster for a donation of $120 or more. To participate, life members need to donate to the CLMF online using our website, or mail their cheque to foundation treasurer, Luc Matteau. Either way, you must include your name, IEEE membership number and grade, and specify the CLMF. Cheques are to be made payable to the "IEEE Canadian Foundation Inc."



The foundation introduced tribute and planned giving in 2010 and we are pleased to recognize our first contributors at the end of this honour roll. Tribute Giving includes gifts in memory of a friend or loved one, as well as gifts in honour of a living individual. Planned Giving involves financial instruments such as life insurance, wills, trusts, and retirement plans.

All the different ways to give and donor recognition programs are fully described on our website, and a second article in this issue also describes all the ways to give.

This year, we introduce in the space below the listing of the Canadian IEEE Heritage Circle Members, where we recognize long standing supporters whose cumulative donations since 1995 total $1,000 or more.

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M.G. Forest

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

Professional Liability Insurance

Are your career, future earnings and assets protected if you're sued? *Are you sure?*

In the *old* days, if you made a mistake on the job, you admitted to it and then business went on as usual. Your client didn't take you to court for *damages*. Rather you took him to a soccer match or hockey game to make up for a mistake, or perhaps golfing or skiing.

However over the past several years, professional liability claims against individuals and firms providing professional services have become more prevalent and more expensive throughout the provinces. Much of the increased litigation is due to more clients realizing their rights and the potential to be compensated further for damages.

WHY ARE PROFESSIONAL LAWSUITS INCREASING?

1. **Competition**
2. **Use of riskier, more high-tech equipment and tools**
3. **Cost of business is more expensive**

Someone has to pay for mistakes!

In our increasingly technological society, mistakes and errors happen. And with more businesses competing for jobs and using more high-tech computer and communication tools, the window opens wider for more errors to occur, even among the most diligent professionals contracted to perform technology-related services.

Whether a claim is frivolous or founded, it can cost thousands of dollars to defend or settle it. And without adequate professional liability insurance, your assets, reputation and future earnings could be at risk.

What is professional liability insurance?

As a technology professional, you provide services that are specialized. When you contract your services, your clients expect you to adhere to a certain level of expertise. If something happens and the job goes wrong, you can be sued and held financially accountable.

Professional liability insurance protects your finances against potential claims and lawsuits made against you by clients. It helps cover the costs of defending a claim against you and pays damages if you're found liable.

Common allegations typically covered by professional liability policies include negligence, misrepresentation, violation of good faith and fair dealing, and inaccurate advice.

Do you really need a policy?

YES, if you own a business, are moonlighting or are self-employed.

It could take everything you own to defend yourself and salvage your reputation. Lawsuits are expensive. Even if the law sides with you, you still have to pay court and attorney costs. Professional liability insurance pays these costs for you.

Plus, in Canada, most contracts require you to have some degree of insurance. If you don't have it, you probably won't be awarded the contract.

POLICY SELECTION CHECKLIST:

- ✔ **Provides prior acts coverage**
- ✔ **Pays defence costs outside policy limits**
- ✔ **Features broad definition of professional services**
- ✔ **Includes technology-related exposures**
- ✔ **Includes defence in licencing board actions**
- ✔ **Reimburses for loss of earnings while attending hearings, etc.**
- ✔ **Offers risk management credits**
- ✔ **Is free of deductible or retention**

What should I look for in a policy?

Purchasing a professional liability policy is a smart safety net in light of today's increasing lawsuits against professional service providers, especially technologists. And even if you already have your own policy, reviewing it to make sure it's up-to-date with current technologies and forms is equally important.

In Canada in particular, the errors and omissions insurance market has not developed as quickly as it needs to in order to meet technology-related exposures. Miscellaneous professional services have not been given the attention they need; medical-related services have gained more prominent attention in the news as well as in the insurance markets. Many insurance companies may have outdated forms or may not have expanded or developed their terms to include technology-related exposures. So even if you already have a policy, you should make sure you have the most robust policy available to protect you.

Here are some things to look for when comparing policies:

- Does the policy provide prior acts coverage? (i.e., does it cover all claims made during your policy's period, regardless of when the act or service occurred?)
- Does it pay for defence costs outside the policy limits?
- Does the policy provide a broad definition of professional services to include what you do as an engineer?
- Does it include technology-related exposures?
- Will it provide a defence in licencing board actions?
- Does it reimburse you for loss of earnings while attending claims hearings or other legal proceedings?
- Is a risk management credit available?
- Is the policy free of a deductible or retention?

Where can I obtain a professional liability policy?

There are various resources from which to obtain a professional liability insurance policy. You may already have a local insurance sales agent for other aspects of your home or business, and your agent may have access to this type of policy. In addition, you can obtain policies online, or directly from insurance companies or third-party brokers who have offices in your province.

The key is to find a resource you can trust that is financially stable, understands the services you provide, includes an updated policy that is in tune with the emerging liability climate among technologists in Canada, and offers you an affordable, competitive rate.

A new, competitive option is now available to IEEE members who reside in Canada.

Thanks to recent insurance carrier negotiations, IEEE members in Canada (except Quebec) now have access to a comprehensive and competitive alternative for their professional liability coverage.

The new Professional Liability Insurance Plan for IEEE members in Canada features benefits uniquely tailored to protect technology-related professional services. Canadian members who are self-employed or in a firm may qualify for this coverage, and they may find the rates lower because of the group buying power of the IEEE membership.

In addition, the plan offers the following:

- Choice of liability protection up to $2 million per claim/$2 million annual aggregate
- Licencing board defence coverage
- Expert legal counsel
- Deductible-free coverage
- Prior acts coverage
- Reimbursement for loss of earnings
- Broad definition of professional services that include technology-related exposures
- Risk management premium credit of 10 percent upon completing the IEEE Risk Management Course

For more details about this new plan, visit: www.ieeeinsurance.com/canadapl or, call Erin Flett at 416-865-3353

This coverage is available to residents of Canada (except Quebec) through R&Q Risk Services Canada Limited. Scott Saddington, Chief Executive Officer of R&Q Risk Services Canada Limited, acts as an agent with respect to residents of Canada.

IEEE has selected Certain Lloyd's Underwriters for this insurance program. Alternative insurance products may be available in the insurance market place. R&Q Risk Services Canada Limited is providing this single insurer option on behalf of IEEE. Marketing is developed by Marsh U.S. Consumer, a Service of Seabury & Smith, Inc.; 55084 I13496 (4/11) ©Seabury & Smith, Inc. 2011

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Many Ways to GIVE

Plusieurs façons de DONNER

Over the past year, the IEEE Canadian Foundation (ICF) has made significant improvements to the donor services we offer. I would like to tell you about the many choices so you can consider which is best for you if you are willing to give back to the IEEE and support the work of our Canadian foundation.

BY MAIL While most IEEE members use email and the web, the ICF always has an alternative if you prefer mail – just use the mailing address above. No matter which method you use, always include your IEEE membership number so we can identify you and include any special requests regarding your donation so we can respond to your wishes. There are forms you can download on our website and mail in with your cheque.

HONOUR ROLL Donors, since 2008, are recognized in our Honour Roll which is published annually in the IEEE Canadian Review. If you wish your gifts to be anonymous, send an email to honour-roll@ieee.ca with "Donor Preference" in the subject line.

MEMBERSHIP RENEWAL Donations made using the membership renewal process are all assigned to the ICF general fund. Other methods enable you to contribute to other ICF funds and receive other benefits.

FOUR FUNDS The ICF has four funds to which you may wish to direct your donation; "General Fund", "Canadian Life Members Fund", "Technology for Humanity Fund", and "Vancouver Section Scholarship Fund". To donate to any of these funds, use either our online service, or mail your cheque to our treasurer. All donors receive CRA tax receipts.

LIFE MEMBERS who donate to the Canadian Life Members Fund are eligible to receive either an LM pin for a $60 (min) gift or a Milestone Coaster for a $120 (min) gift.

ONLINE If you use our online service – use the URL above and click on "Donate Online" - you have several choices: one-time or monthly donations, four foundation funds, giving anonymously, an option to dedicate your donation "in memory of" or "in honour of", and payment by any of Visa, MasterCard, AmEx, Interac or PayPal.

PLANNED GIVING In addition to direct gifts of cash (cheque or electronic funds), we ask that you consider a planned future gift such as:

- LIFE INSURANCE - name the IEEE Canadian Foundation as your beneficiary or donate an existing policy that you no longer need,
- WILL OR TRUST PROVISION - make a charitable bequest to the IEEE Canadian Foundation in your will or living trust,
- RETIREMENT PLAN - avoid "double taxation" by naming the IEEE Canadian Foundation as beneficiary of your retirement plan.

Thank you in advance for your next donation.

Sincerely,

Robert T.H. (Bob) Alden, P.Eng, LFIEEE
President
president@ieeecanadianfoundation.org

http://www.ieeecanadianfoundation.org/EN/donations.php

Au fil du temps, la Fondation canadienne de l'IEEE (FCI) a amélioré les outil s disponibles pour ses donateurs. J'aimerais vous présenter ces outils afin que vous choisissiez ceux qui sont les plus appropriés si vous désirez poursuivre vos dons à l'IEEE et supporter les œuvres de la FCI.

PAR COURRIER Tandis que la plupart des entités de l'IEEE emploient le courriel et le Web, la FCI offre toujours l'alternative du courrier si vous le préférez - employez simplement l'adresse d'envoi indiquée ci-dessus. Peu importe la méthode employée, n'oubliez pas d'inclure toujours votre numéro d'adhésion à l'IEEE ainsi nous pourrons vous identifier. De même vous pouvez nous faire part de requêtes particulières concernant votre don et nous pourrons répondre à vos souhaits. Il y a des formulaires en ligne sur notre site web que vous pouvez compléter et retourner avec votre chèque.

TABLEAU D'HONNEUR Depuis 2008, les donateurs, sont identifiés sur notre Tableau d'honneur qui est mis à jour annuellement dans la Revue canadienne de l'IEEE. Si vous souhaitez que vos dons restent anonymes, envoyez un courriel à honour-roll@ieee.ca avec « Préférence du donateur » en ligne sujet.

RENOUVELLEMENT D'ADHÉSION Les dons faits via le processus de renouvellement d'adhésion sont assignées au « Fonds général de la FCI ». Les autres modalités permettent de contribuer aux autres fonds de la FCI et reçoivent d'autres avantages (voir plus bas).

QUATRE FONDS La FCI a quatre fonds auxquels vous pouvez diriger votre don: « Fonds général », « Fonds canadien des membres à vie », « Technologie pour le fonds humanitaire », et « Fonds de bourse de la Section IEEE de Vancouver ». Pour donner à ces fonds, employez notre service en ligne, ou expédiez votre chèque à notre trésorier. Tous les donateurs reçoivent des feuillets fiscaux de l'ACR.

MEMBRES À VIE Les membres à vie qui donnent au Fonds canadien des membres à vies reçoivent une épinglette des MàV pour un don de $60 (minimum) ou un plaquette commémorative d'un jalon historique de l'IEEE pour un don de $120 (minimum).

EN LIGNE Si vous employez notre service en ligne - employer le lien indiqué plus haut et cliquer sur « Dons en ligne» - vous avez plusieurs choix: don unique ou mensuel, quatre fonds de base, don anonyme, une option pour dédier votre don "en mémoire de" ou "en l'honneur de". Le paiement se fait par Visa, Mastercard, Amex, Interac ou PayPal.

PLANIFIER VOS DONS En plus des dons en argent (chèque ou fonds électronique), vous pouvez considérer un don futur tel que:

- ASSURANCE-VIE - nommez la Fondation canadienne de l'IEEE comme votre bénéficiaire ou donnez une police existante dont vous n'avez plus besoin,
- DON TESTAMENTAIRE - faite un legs charitable à la Fondation canadienne de l'IEEE dans votre testament,
- RÉGIME DE RETRAITE - évitez la "double taxation" en nommant la Fondation canadienne de l'IEEE comme bénéficiaire de votre régime de retraite.

Encore, merci de votre don et de vos dons futurs.

Sincèrement,

Robert T.H. (Bob) Alden, P.Eng, LFIEEE
Président
president@ieeefondationcanadienne.org

http://www.ieeefoundationcanadienne.org/FR/dons.php

Translation courtesy of Xavier Maldague

Concussions, Athletics and the Profession of Engineering

By Terrance Malkinson

Traumatic Brain Injury (TBI) resulting from athletic involvement is attracting considerable attention. Immediate medical care costs are considerable. Some patients live with lifelong disabilities. Many are unable to return to their work because of physical or mental disabilities. Adverse long-term behavioral and personality changes resulting from TBI may predispose individuals to progressive dementia, disinhibition, impulsivity, aggression, and violent behavior.

The Trauma Association of Canada (TAC) [www.traumacanada.org] is a multi-disciplinary society of the College of Physicians and Surgeons of Canada dedicated to reduce the incidence of injury, ensure optimal care of the injured patient, and provide leadership in collaboration with other health care providers, agencies, and individuals for physicians and surgeons, allied health care professionals and the Canadian community at large. As stated on their website:

"*For severe TBI, immediate medical costs are more than $400,000, post-treatment costs can amount to more than $60,000 each year. In Canada and the USA, it is estimated that 2% of the population live with lifelong disabilities resulting from TBI. More than 100,000 people in Canada are admitted to hospital with mild to moderate closed head injury.*"

Today, athletes participating in many sports are experiencing a dramatic increase in concussion injuries. The romantic image of children playing hockey on a pond that appears on Canada's five-dollar bill is being replaced by disturbing pictures of athletes lying unconscious. This is resulting in an ever-growing list of athletes severely affected by head injuries including high profile stars such as Sidney Crosby as well as amateurs and young children. Although hockey is currently the subject of much media attention concussions occur in many sports and also occur as a result of incidents that have no association with sports. Bigger and faster players are colliding with each other and with surfaces at higher speeds. Athletes are often outfitted with body-armour type equipment that gives them a feeling of invincibility. There is a sense that the athletics establishment does not recognize the seriousness of the problem. Many athletes and sports administrators think that the game is "just fine as it is." The culture of aggressive speed, body contact and fighting is valued by many athletes, the media, and fans.

It is important to remember that participation in athletic activities is an honorable pursuit that facilities development—building character and teaching life skills important for personal and career success. Internationally, it is better that nations work out their differences on the athletic field rather than on the battle field. Unavoidable accidental injury will always occur, regardless of safeguards. The athletics sector has a large product and services economic impact and is generally recession-proof and somewhat insensitive to economic fluctuations.

Politicians, sports administrators, team owners, corporate sponsors, media, police, health care providers, fans, parents, and the athletes themselves are becoming increasingly concerned. Young people, student-athletes and professional athletes participating in many sports are experiencing serious acute and chronic health impairment resulting from single or multiple blows to the head.

The Injury

Definition of concussion is vague and diagnosis is achieved through a variety of symptoms. The brain weighs about three pounds. It floats inside the skull, surrounded by a thin layer of spinal fluid, not quite in contact with the skull. A concussion often is a direct result of a rapid front-to-back or side-to-side movement of the head. Brain tissue is jelly-like in consistency, and damage results as the brain ricochets back and forth colliding with the sides of the skull. The brain may bleed and/or the neurons and pathways that we use to think, learn and remember are damaged. Concussions can cause acute symptoms of headache, nausea, dizziness, and unconsciousness. Chronic symptoms might include trouble with lights and sounds, memory problems, difficulty in multi-tasking, depression, violence and progressive dementia. Simply put, the brain doesn't work the way it did before. Medical research is ongoing and new knowledge is emerging on how concussions can be avoided, identified and treated.

The Center for the Study of Traumatic Encephalopathy (CSTE) [www.bu.edu/cste] is a leader in research on head trauma in sports. The CSTE Brain Bank collects and studies post-mortem human brain and spinal cord tissue to better understand the effects of trauma on the human nervous system. The CTSE has analyzed the brains of former athletes upon their death and found that many showed signs of Traumatic Encephalopathy. Athletes include former NFL players, college and high school football players, hockey players, pro wrestlers and boxers.

It is clear that there is a pressing problem and that something must be done about TBI and quickly. A multi-pronged and multi-disciplinary approach to changing the athletic culture is needed. Prohibiting deliberate hits to the head coupled with severe penalties to curb even the temptation to transgress are starting points. Every stakeholder has an interest and social responsibility to set the boundaries and enforce them.

Canadian Research

A research study was recently published entitled "Effect of Bodychecking on Rate of Injuries Among Minor Hockey Players" [*Open Medicine*, 5(1), 2011, www.openmedicine.ca/article/view/246/391] by Michael Cusimano et al of the Injury Prevention Research Centre at St. Michael's Hospital in Toronto [www.stmichaelshospital.com/programs/trauma]. They found that 9- and 10-year-old minor league hockey players were ten times more likely to suffer a brain injury after body-checking was allowed in the 1998/1999 season. Attendance at an emergency department due to a brain injury from body-checking increased significantly among all minor hockey players after body-checking rules were relaxed. While all age groups showed increases in injuries, the youngest were the most vulnerable.

In another Canadian study researchers found that coaches and teammates have a greater influence on young players than their parents. This study published in the journal Leadership Quarterly and conducted at the Universities of Manitoba, Queen's, and Regina looked at 183 male hockey players of average age of 13 years in two Ontario leagues. ["Coaches Matter More than Parents in Promoting on-Ice Aggression." www.umanitoba.ca/news/blogs, March 10th, 2011]. The study found that the more coaches and parents endorsed aggression, the less likely players were to view them as leaders worthy of following. Nick Turner, one of the study's authors states that "What should really be taken away from this study is that we should really think carefully about the selection of team coaches and the messages that they send their teams."

The largest concussion study ever conducted in professional hockey was recently published [May 17, 2011] in the Canadian Medical Association Journal [www.cmaj.ca]. Entitled "A prospective study of concussions among National Hockey League players during regular season games: the NHL-NHLPA Concussion Program," this Canadian study contributes to our understanding of the natural history of concussion suffered by male professional ice-hockey players. Researchers at the Sport Medicine Centre in the University of Calgary's Faculty of Kinesiology in conjunction with the NHL and the NHL players association compiled reports from every team doctor over the period 1997-2004. Data for the years 2006-2011 is slated for release later this year. Post-concussion headache, low energy or fatigue, amnesia and abnormal neurologic examination were significant predictors of time loss among professional hockey players. The report concludes with the suggestion that "more should be done to educate all involved with the sport."

The Role of Engineers and Scientists

Engineers and scientists in their professional and objective role to protect the public interest have in the past and must in the future play a mandatory role in the design and testing of athletic sporting facilities and sporting equipment as well as in the setting of standards. Sports administrators and manufacturers must be compliant with their directives. Biomedical engineers and medical scientists must play a role in the development of instrumentation for diagnosis and treatment of athletes that regrettably become injured. Medical protocols need to be developed by independent health care professionals and complied to by sports administrators when an incident occurs.

Helmet design as an element of athlete protection is evolving. Mark Messier spent a quarter of a century in the NHL with the Edmonton Oilers, New York Rangers, and Vancouver Canucks and is considered

one of the great NHL players. The Messier Project [www.themessierproject.com] is an initiative aimed to change priorities in the sport by encouraging athletes to play smart and choose the best protective equipment. The Messier Project is promoting the innovative M11 helmet, which features a liner that uses an impact attenuation system to manage energy transfer from direct impact. Helmets may prevent a skull fracture but will not necessarily prevent the brain from injurious movement within the skull.

Engineers who are members of professional associations must bring attention to the issue of TBI mitigation. The American Society for Testing and Materials International [www.astm.org] is a globally recognized leader in the development and delivery of international voluntary consensus standards. The Canadian Recreation Facilities Council [www.crfc.ca] is a recognized national leader and advocate for all recreation facility associations and similar organizations. The IEEE [www.ieee.org] in its role as the world's largest professional association for the advancement of technology has an important role through the activities of societies such as Engineering in Medicine and Biology, Product Safety Engineering, as well as through its standards association and working groups. Education of athletes, coaches and parents is essential. Hockey Canada has a concussion awareness program with information and resources at: www.hockeycanada.ca/index.php/ci_id/60967/la_id/1.htm . The Journal of Trauma Injury, Infection, and Critical Care [http://journals.lww.com/jtrauma] focuses specifically on traumatic injuries.

Conclusion

Ken Dryden, former Member of Parliament for York Centre, seven season NHL player, and a member of the Hockey Hall of Fame recently published an article in *The Globe and Mail* "Ken Dryden on Hockey Violence: How Could we be so Stupid?" March 12, 2011 [www.theglobeandmail.com]

"*We can only say that we didn't want to know. We thought—we hoped—there wasn't a problem, because if there were, something would need to be done, and we didn't want to do it. To do something would change the nature of the game ... The voices of the future will not be kind to us about how we understood and dealt with head injuries in sports. They will ask: How is it possible we didn't know, or chose not to know? For players or former players, owners, managers, coaches, doctors and team doctors, league executives, lawyers, agents, the media, players' wives, partners and families, it's no longer possible not to know and not to be afraid, unless we wilfully close our eyes ... The NHL has to risk the big steps that are needed: If some of them prove wrong, they'll still be far less wrong than what we have now. It is time to stop being stupid.*"

Participation in athletics is important to our culture and has many benefits including building citizens that serve our society well; investment in reducing brain trauma is well justified. However, for some sports, the risk-taking is a key draw, with thrill-seeking a strong motivator for participants. So while it will never be possible to eliminate brain trauma in sports completely, with innovation and respect, we will mitigate the risk.

About the Author

Terrance Malkinson is a communications specialist, business analyst and futurist. His career path includes technical supervisor and medical researcher at the University of Calgary, business proposal manager for the General Electric Company, and research administrator with the School of Health and Public Safety at SAIT Polytechnic in Calgary. He is currently an international correspondent for IEEE-USA *Today's Engineer*, associate editor for *IEEE Canadian Review*, and a member of the editorial advisory board of IEEE *The Institute*. He was Vice-Chair of the IEEE-USA Communications Committee (2004-2010), and editor-in-chief of IEEE-USA *Today's Engineer Digest* (2004-2008). He was an elected Governor of the IEEE Engineering Management Society as well as past editor of IEEE *Engineering Management*. He is the author of more than 420 publications, and an accomplished triathlete.
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Research and Development Tax Credit Claim Denied?

Know your options…

by David R. Hearn, CET; A. Christina Tari, LLB LLM

Every year, Canada's Scientific Research & Experimental Development (SR&ED) tax credit program delivers approximately $4 billion in R&D tax credit incentives to Canadian businesses. A surprisingly large portion of this $4 billion—likely half of it—makes its way into the engineering community.

Any company that has had its SR&ED claims audited within the last four years has likely found that Canada Revenue Agency ("CRA") has substantially tightened its eligibility criteria.

To be fair, some of this tightening is justified and is supported by the governing legislation—which in this case is the federal Income Tax Act (the "Act"). The Act is surprisingly vague—about 250 words—in defining the type of work that qualifies as SR&ED. The Act is further clarified by about 125 or so rulings issued by the Tax Court Canada and other courts including the Federal Court of Appeal.

A surprisingly large portion of this $4 billion…makes its way into the engineering community.

CRA publishes various administrative policies and interpretation bulletins on SR&ED that are available on its website. However it is important to understand that these documents are not law. Rather they are statements of administrative policy intended to inform taxpayers how CRA auditors are going to interpret the law. Generally, CRA auditors will adhere to these, however, any taxpayer attempting to cite these in defence of their claim may be surprised to find that they are not obliged to do so. It is interesting to note that CRA's website does not provide a copy of the Act.

Unfortunately for taxpayers, the number of SR&ED eligibility rulings that are not supported by either the legislation or any court precedents has been increasing over the last few years. However, recognizing these is beyond the expertise of both taxpayers and most accountants.

How severe is the problem? Severe enough that the federal government has recently set up two separate investigations to review the situation. In September 2009 the Taxpayer's Ombudsman was tasked with a "systemic inquiry" aimed at finding out if CRA has correctly administered the SR&ED program in accordance with the existing legislation. The Ombudsman's report has been delayed three times and is now expected to be released sometime in late 2011. In October 2010, Ottawa set up a six-member SR&ED expert review panel to review the economic benefits of all government funding for R&D, including SR&ED. The expert panel received approximately 200 submissions. The following excerpt is taken from the submission made by The Canadian Federation of Independent Business:

"*There is concern with inconsistency in the decisions being made on SRED applications. Some members have had their applications denied after having had it accepted for the exact same type of work a year earlier while others have told us about firms doing similar types of R&D but having one application accepted in one part of the country but denied in another.*"

We see two possible reasons for the growing number of flawed SR&ED assessments: First, the government has been in cost-containment mode for several years and has now entered a new phase of even more vigorous cost cutting. Second, the surge of program review activity (Ombudsman inquiry, Jenkins Expert Panel, etc.) is triggering a series of policy "adjustments" that are rippling through CRA's SR&ED organization with somewhat unpredictable results.

There are a number of redress measures available for taxpayers that have experienced a flawed assessment. In some cases it might be possible to get a slightly improved outcome by dealing with the auditor or the local CRA office directly before the assessment is issued. Sadly, we are finding that CRA has become much less open to this approach. In today's climate, there are really only two choices for redress on denied SR&ED claims: serving a Notice of Objection ("NoO") or going to the Tax Court ("TCC").

The NoO route is potentially useful for specific expenditure issues in an otherwise eligible claim, but are generally of little value on science eligibility issues. Another drawback is that the backlog of SR&ED related objections is now so large that it will take from 24 to 36 months for the process to even start. However the real problem with the NoO route is that you're still dealing with CRA personnel who are operating under the same set of administrative policies that very likely gave rise to the problem in the first place.

The TCC route is really the only viable choice if the issues involve scientific eligibility. The advantage that TCC has over all other redress options is that the dispute is adjudicated on "neutral" ground: solely in accordance with the provisions of the Act and precedents set in previous court rulings. CRA "policies" are essentially removed from the equation. The TCC route can also be substantially faster than the NoO. However, the TCC route is a highly structured, formal process for which taxpayers should seek legal representation. Another plus for the TCC route is the possibility of a pre-trial settlement conference, which can substantially reduce the time and costs required.

For a full analysis of the cost and timelines for the various options by which taxpayers can seek redress on SR&ED assessments—plus some additional SR&ED related learning materials such as the legislation excerpts—please visit the authors' website www.scitax.com/IEEECanada; UserName = IEEEGUEST, Password = SLJ3355.

About the Authors

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Managing Director, Scitax Advisory Partners LP

David David Hearn is a senior expert in planning, preparing and defending SR&ED tax credit filings. He has more than 15 years experience in the SR&ED field, 10 years of which were served with a multinational chartered accounting firm. Prior to this he held engineering and R&D positions in the electronics industry.

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Christina is a tax litigation lawyer who has practiced exclusively in the field of taxation since 1987. She was called to the Bar in 1984. From 1989 until 1997 she was a tax litigation counsel with the Canadian Department of Justice where she represented the Crown in Tax Court of Canada and other legal actions pertaining to taxation.

IEEE Canada Mentors and Teachers: A Meeting of Long-Lost Cousins

Region 7 holds its 2nd TISP workshop with participants from coast to coast

The preparation had been exhaustive—of that they were confident. The 30-odd member team mounting Region 7's second Teacher In Service Program (TISP) workshop had recruited enthusiastic teachers and dedicated IEEE Canada volunteers from Victoria to Newfoundland. As the two-day program held April 28-29 in Mississauga came to a close, 25 windmill designs now graced the display table; earlier that day as many LEDs had lit up one-by-one as participants correctly configured the resistors in the voltage divider exercise.

But as the wrap-up panel discussion began, the questions going through Region 7 TISP Committee Chair Anader Benyamin's mind were: "Had they *really* connected with these teachers? Could they all build on the relationships established?" Then, Brad North, technology teacher at Rick Hansen Secondary School in Mississauga, took the microphone.

"It's as if I have found my long-lost cousin here," North explained. "I have been looking for engineers to help me with all these engineering concepts and you have been looking for teachers." It seemed that Benyamin and his "teammates" had done more than connect: they'd hit one out of the ballpark!

While the workshops provide the ideal in one-on-one training, Toronto Section TISP co-chair Patrick Finnigan and Hamilton Section Life Member Dave Hepburn have found other ways of reaching teachers. Dating back to 2007, Hepburn began staffing an IEEE booth at the Science Teachers' Association of Ontario annual conference. More recently, he and Finnigan have been giving a workshop demonstrating one of the 85 lesson plans on TryEngineering.org, an on-line resource developed jointly by IEEE and IBM. The lesson plans can all be complemented with research activities, Finnigan says.

Photo: Jennifer Ng Ain Kin, SMIEEE

A correctly wired voltage divider brings the smile lighting up the face of TISP participant Christopher Simon (left), as IEEE mentor Dave Hepburn looks on.

"But the core of each lesson plan is building something—that's what engineering is all about."

For students considering careers in technology/engineering/science, there's nothing quite like having someone from industry to provide that "real world" perspective. Luckily for students of North and his teaching colleagues, Finnigan's Toronto Section TISP Co-Chair partner, Dennis Cecic, can do just that. A training engineer with Microchip Technology Inc, Cecic teaches other engineers how to develop programs for microcontrollers. After being recruited several years ago to serve as a judge in a robotics competition organized by North and others, Cecic saw an opportunity to help upgrade the robots' microcontrollers from 8-bit to 16-bit.

"With these microcontrollers you can run a TCP/IP stack," says Cecic. "In the future, the robot can even host a website so an iphone can load the status of the robot in realtime, adding a networking component to the project." Cecic is currently working with a group North helped found—the Computer Engineering Teachers Association—to develop a five-day workshop to allow the robot project to be adopted by other school boards. While he acknowledges teachers can already choose a commercially available pre-packaged robotics kit, he projects the cost of what he and North are developing will be considerably less, likely under $100.

In Vancouver's University Hill Secondary School, activity costs are definitely a concern for science teacher Vincent Tang, another TISP participant. Any hands-on activity must be inexpensive enough to be replicated sufficientlty so that materials don't need to be moved from class to class, he says. Another challenge he faces is balancing the increasing depth of the B.C. science curriculum with the benefits of exploration—"keeping them just as enthusiastic as they probably were in Grade 8. Even at the senior level, exploration is still pretty important." Tang sees the windmill activity as meeting both needs. "There's a real depth to the unit. I see our society slowly moving towards wind power—it can capture students' imagination."

While for North the metaphor was kinship in describing how TISP brings together engineers and teachers, for Tang it was dialogue, a feature of the Mississauga workshop's panel discussion conducted by veteran TISP volunteer Jennifer Ng from Ottawa Section. "I was quite delighted to hear that both sides see a need for each other," Tang recalls. "It was the first time I've been in a conversation where there was a connection between the two. I look forward to more!" With the next TISP workshop scheduled for Vancouver in 2013, Tang and his colleagues won't have to go far to advance that dialogue.

As Region 7's TISP Committee now looks to the 2013 workshop, many thanks are due to IEEE EAB for its generous and continued support. ■

Engineering Management: What's New in the Literature?

by Terrance Malkinson

On: Leadership Potential, Mobile Access to Academic Libraries, Canadian College/Industry Partnerships, Careers of the Future, Skyscraping City Savers, Report on BP Gulf Oil Disaster, Subway Expansion Innovation, Business Model Innovation, Airline Travel

- Many people fail to achieve their leadership potential because they unintentionally get in their own way. Based on their research encompassing a wide variety of organizations, Anne Morriss, Robin Ely, and Frances Frei identify five barriers preventing good managers from transitioning to good leaders. [*Harvard Business Review*. 89(1/2):160-163. January-February, 2011. www.hbr.org]. Barriers to leadership success include an overemphasis on personal goals, protection of your personal public image, turning competitors into two-dimensional enemies, failure to solicit support and advice, and waiting for permission to lead. The authors conclude "being a leader means making an active decision to lead."

- Continuing in the same issue of *Harvard Business Review* with the theme of leadership potential, Linda Hill and Kent Lineback come to the conclusion that managers often reach a certain level of proficiency and then stop short of their real potential. Their ideas are discussed in "Are You a Good Boss or a Great One?" [pp. 125-131]. The authors discuss three strategies that managers might use to avoid stagnation. They offer an assessment tool for "measuring yourself on the three imperatives" to help you get started on the path to growth.

- A rapidly increasing number of people are using mobile devices to access the Internet. Jamie Seeholzer and Joseph Salem have explored through student focus groups the use and expectations for an academic library's mobile web site. ["Library on the Go: A Focus Group Study of the Mobile Web and the Academic Library," *College and Research Libraries*. 72(1):9-20. January, 2011]. Through their research they found that students were interested in mobile access to the library catalogue, research databases and references services. Additionally, they preferred contacting and being contacted by the library using text messaging. Their report provides insights into how to design a library's mobile website.

- Canadian Colleges are becoming an increasing presence in the research community utilizing their expertise in facilitating mutually beneficial applied research and commercialization solutions to industry. The Colleges Ontario Network [www.conii.ca] is a network of 20 Ontario colleges dedicated to connecting business with collegiate applied research and commercialization expertise. From its founding in 2006, it has successfully helped many small and medium enterprises solve their technical problems, adopt new technologies for the marketplace, and develop new or improved products and processes. Information on services, the project proposal process, identification of funding sources, industry testimonials, and success stories of practical solutions to industry problems are provided on their website.

- No one can predict the future with certainty; however you can increase your chances of success by developing a future consciousness. Cynthia Wagner provides a listing of 70 jobs that are forecasted to emerge in "70 Jobs for 2030," [*The Futurist*. 45(1):30-33. January-February, 2011. www.wfs.org]. The author also discusses three basic approaches used when thinking about future careers. Looking at the past, a special report in *IEEE Spectrum* [January, 2011. pp 27-63] provides a summary on each of what it believes to be the "Top Eleven Technologies of the Past Decade." Each of the eleven summaries provides valuable glimpses into the technology, its development, and its impact.

- A series of feature articles in *The Atlantic* discusses skyscrapers and their potential to make cities more affordable and architecturally interesting. [307(2). pp. 40-57. March, 2011. www.theatlantic.com]. In "How Skyscrapers Can Save the City," Edward Glaeser discusses how skyscrapers can do much more than simply provide space for people; rather they can also connect people, foster creativity, and accelerate social progress. In "How High Can We Go?" Alexis Mandrigal discusses technology and financial challenges required to construct tall buildings. Currently, the world's tallest building is the 160-story, 2,717-foot Burj Khalifa in Dubai. In "The Architect of the City," Benjamin Schwarz reviews the work of Louis Sullivan, considered the "father" of architectural modernism and the skyscraper, as well as mentor to Frank Lloyd Wright, creator of some of America's greatest buildings.

- Peter Elkind and David Whitford provide an in-depth investigative report on one of the worst industrial disasters in history—the BP Gulf Oil disaster in "An Accident Waiting to Happen". [*FORTUNE Magazine* [163(2):105-132. February 7, 2011. www.fortune.com]. This comprehensive report analyses this tragic event from its antecedent environment to where we are now.

- A feature report on Biomass as a fuel for the 21st century is provided in *Green Building Magazine* [20(3):30-53. Winter, 2010. www.greenbuildingmagazine.co.uk]. In a series of articles, it is described how biomass from forestry-sourced wood can be a natural and renewable fuel that is grown and harvested in a manner not at the expense of other uses for wood. The advantages of biomass as a fuel discussed in the articles include: it can be grown locally close to where the energy is needed; it is energy secure; it requires simple technology; and, it is environmentally protective. Case studies are provided where wood has been successfully used as a fuel. Other topics discussed in the feature report include biomass technology adoption and a discussion forum on whether biomass is actually a green fuel or not.

- In a special infrastructure report in *Engineering News-Record*, Aileen Cho describes the construction of three subway transit extension tunnels in New York City. ["Cavernous Crusades". 266(4):26-33. February 7, 2011. www.enr.com]. Three giant tunnel boring machines are now at work deep beneath New York City to meet the needs of hundreds of thousands of commuters. Many engineering firsts are associated with this multi-billion dollar project. One of these is the use of "ground-freezing technique" to overcome the challenges of boring through soft and wet soil.

- A good and relevant business model is essential for success of the organization, however it is often difficult for business leaders to determine the best model. Ramon Casadesus-Masanell and Joan Ricart discuss the essentials of a business model, the characteristics of a good business model, how business models generate virtuous cycles, competing with business models, and a comparison among business models vs. strategy and vs. tactics in ["How to Design a Winning Business Model" *Harvard Business Review* 89(1/2): 100-107. January-February. 2011]. This is one of several articles in this issue of *HBR* that focuses on business model innovation.

- Airline travel is seen by many as challenging. *Business Traveller* has published a supplement "Airline Survey: Your Essential Guide for 2011" [34(9) suppl. 2010] that provides information in helping you choose the best airline, class, and seat for your trip. This survey was created in conjunction with Seatplans.com [www.seatplans.com] and provides comprehensive information for many airlines and their aircraft on plane type and class; seat configuration, pitch, width, length, recline, and type; personal screens; audio-video; and power source. The "Seatplans" website provides you with an interactive opportunity to enter your journey details, compare statistics and ratings for airlines and individual flights, share your experiences, and view detailed seating plans.

***Author biography*: see page 33**

Conferences: IEEE & Collaboration • Canada • 2011

WEST

Joint 20th IEEE Int'l Symposia on Applications of Ferroelectrics / Piezoresponse Force Microscopy & Nanoscale Phenomena in Polar Materials
2011-07-25...27, Vancouver, BC
http://www.sfu.ca/isaf2011

IEEE International Geoscience and Remote Sensing Symposium (IGARSS)
2011-07-24...29, Vancouver, BC
http://igarss11.org

IEEE Pacific Rim Conference on Communications, Computers and Signal Processing (PacRim)
2011-08-23...26, Victoria, BC
http://www.ece.uvic.ca/~pacrim

5th Int'l Symposium on Empirical Software Engineering and Measurement (ESEM)
2011-09-22...23, Banff, AB
http://esem.cpsc.ucalgary.ca/esem2011

IEEE Electrical Power & Energy Conference (EPEC)
2011-10-03...05, Winnipeg, MB
http://www.ieee.ca/epec11

19th IEEE Int'l Conference on Network Protocols (ICNP)
2011-10-17...20, Vancouver, BC
http://www.cs.utah.edu/~mprobst/ICNP2011

IEEE Haptics Symposium (HAPTICS)
2012-03-04...07, Vancouver, BC
http://hapticssymposium.org

IEEE Int'l Magnetics Conference (INTERMAG)
2012-05-07...11, Vancouver, BC
http://www.intermagconference.com

CENTRE

22nd IEEE Int'l Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)
2011-09-11...14, Toronto, ON
http://ieee-pimrc.org/2011

IEEE Petroleum and Chemical Industry Technical Conference (PCIC)
2011-09-19...21, Toronto, ON
http://www.ieee-pcic.org/Conferences/2011_Toronto

EAST

7th Int'l Workshop on Fibre Optics and Passive Components (WFOPC)
2011-07-13...15, Montréal, QC
http://www.wfopc2011.com

IEEE Photonics Society Summer Topical Meeting Series
2011-07-18...20, Montréal, QC
http://www.i-leos.org

Ninth Annual International Conference on Privacy, Security and Trust (PST)
2011-07-19...21, Montréal, QC
http://www.unb.ca/pstnet/pst2011

IEEE International Symposium on Robotic and Sensors Environments (ROSE)
2011-09-17...18, Montréal, QC
http://rose2011.ieee-ims.org

IEEE Int'l Conference on Virtual Environments, Human-Computer Interfaces and Measurement Systems (VECIMS)
2011-09-19...21, Ottawa, ON
http://vecims2011.ieee-ims.org

IEEE Int'l Conference on Computational Intelligence for Measurement Systems and Applications (CIMSA)
2011-09-19...21, Ottawa, ON
http://cimsa2011.ieee-ims.org

10th Annual Workshop on Network and Systems Support for Games (NetGames)
2011-10-06...07, Ottawa, ON
http://www.discover.uottawa.ca/netgames2011

25th IEEE Canadian Conference on Electrical and Computer Engineering (CCECE)
2012-04-29...05-02, Montréal, QC
http://www.ieee.ca/ccece12

IEEE Int'l Conference on Communications (ICC)
2012-06-10...15, Ottawa, ON
http://www.ieee-icc.org/2012

IEEE/MTT-S Int'l Microwave Symposium (MTT)
2012-06-17...22, Montréal, QC
http://www.mtt.org

79th ARFTG Microwave Measurement Conference (ARFTG)
2012-06-22, Montréal, QC
http://www.arftg.org

American Control Conference (ACC)
2012-06-27...29, Montréal, QC
http://a2c2.org/conferences/acc2012

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IEEE Canada

CCECE 2012 (Silver Anniversary)

25th Annual Canadian Conference on Electrical and Computer Engineering

April 29–May 2, 2012, Montreal, Quebec

"Vision for a Greener Future"

Call for Papers and Proposals

The 2012 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE 2012) will be held in Montreal, Quebec, Canada April 29 to May 2. CCECE 2012 provides a forum for the presentation of electrical and computer engineering research and development from Canada and around the world. Plenary speakers include Vahid Tarokh from Harvard University, Peter Caines from McGill University and Gregor Bochmann from the University of Ottawa.

Papers are invited, in French or English, for the following symposia:

- **Circuits, Devices and Systems**
  Chairs: Drs. Karim Karim (University of Waterloo), Shahriar Mirabbasi (University of British Columbia)
- **Control and Robotics**
  Chairs: Drs. Stephen Smith (University of Waterloo), Joshua Marshal (Queen's University)
- **Power Electronics and Energy Systems**
  Chairs: Drs. Bala Venkatesh (Ryerson University), Olivier Trescases (University of Toronto)
- **Signal and Multimedia Processing**
  Chairs: Drs. Fabrice Labeau (McGill University) Xianbin Wang (University of Western Ontario)
- **Biomedical and Health Informatics**
  Chairs: Drs. Carolyn McGregor (University of Ontario Institute of Technology) Tiago H. Falk (Institut National de la Recherche Scientifique)
- **Computers, Software & Applications**
  Chairs: Drs. Jagath Samarabandu (University of Western Ontario) Hamid Mcheick (Université du Québec à Chicoutimi)
- **Communications and Networking**
  Chairs: Drs. Anader Benyamin-Seeyar (Concordia University), Shahram Yousefi (Queen's University), Mark Coates (McGill University)

NOTE: Selected papers accepted in this conference will be proposed for publication in IEEE *Systems Journal* and IEEE *Canadian Journal of Electrical & Computer Engineering*, after another round of review. Authors wishing to submit papers that do not fit within any of the symposia topics listed above are encouraged to do so to the "general interest" symposium.

Regular Paper Submission

Please submit original full length paper(s) to the Technical Program Committee using the on-line submission process on our web site at http://www.ccece2012.org before January 7, 2012. Click on "Call For Papers" and follow the instructions provided.

Tutorial and Workshop Proposals Submission

Proposals for half-day tutorials and workshops should be submitted before December 2, 2011 to the Tutorials Chair at tutorials@ccece2012.org.

Important Dates

Tutorial or workshop proposals must be received by:	Friday, December 2, 2011
Full length papers must be received by:	Friday, January 7, 2012
Notification of acceptance will be sent out by:	Friday, February 24, 2012
Author's Registration ends by:	Friday, March 9, 2012
Advance Registration ends by:	Friday, March 30, 2012

Industrial Exhibits and Sponsorships

For industrial exhibits please contact the Industrial Exhibits Chair at exhibits@ccece2012.org.
For sponsorships please contact the Sponsorships Chair at sponsorship@ccece2012.org.

Questions or Comments

To volunteer as a reviewer, please contact Tech. Program Co-Chairs: Scott Yam (scott.yam@queensu.ca), Lacra Pavel (pavel@control.toronto.edu) and Gerry Moschopoulos (gmoschopoulos@eng.uwo.ca).

For any questions or comments, please contact the Conference Chair:
Amir G. Aghdam. Ph: 514 848-2424 Ext. 4137, Fax: 514 848-2802 Email: aghdam@ece.concordia.ca

http://www.ccece2012.org

IEEE Canada

CCGÉI 2012 (25e anniversaire)

25ème Congrès canadien de génie électrique et informatique

29 avril au 2 mai 2012, Montréal, Québec

"Vision pour un futur plus écologique"

Appel de communications et propositions

Le Congrès canadien de génie électrique et informatique édition 2012 (CCGÉI 2012) aura lieu à Montréal (Québec), Canada du 29 avril au 2 mai. Le CCGÉI 2012 constitue un forum où les recherches et développements en génie électrique et informatique effectués au Canada et dans le reste du monde sont présentés. Les conférenciers de séances plénières incluent Vahid Tarokh de l'Université Harvard, Peter Caines de l'Université McGill et Gregor Bochmann de l'Université d'Ottawa.

Nous vous invitons à présenter des communications, en français ou en anglais, pour les symposiums suivants :

- **Circuits, dispositifs et systèmes**
  Prés: Drs. Karim Karim (University of Waterloo), Shahriar Mirabbasi (University of British Columbia)
- **Commande et robotique**
  Prés: Drs. Stephen Smith (University of Waterloo), Joshua Marshal (Queen's University)
- **Électronique de puissance et systèmes énergétiques**
  Prés: Drs. Bala Venkatesh (Ryerson University), Olivier Trescases (University of Toronto)
- **Traitement du signal et multimédia**
  Prés: Drs. Fabrice Labeau (Université McGill), Xianbin Wang (University of Western Ontario)
- **Ordinateurs, logiciels et applications**
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- **Informatique santé et biomédicale**
  Prés: Dr. Carolyn McGregor (University of Ontario Institute of Technology) Tiago H. Falk (Institut National de la Recherche Scientifique)
- **Communications et réseaux**
  Prés: Drs. Anader Benyamin-Seeyar (Université Concordia), Shahram Yousefi (Queen's University), Mark Coates (Université McGill)

N.B.: Les articles sélectionnés pour cette conférence seront proposés pour publication dans l'*IEEE Systems Journal* et le *Journal canadien de génie électrique et informatique*, après un autre cycle de révision. Les personnes qui souhaitent soumettre des communications sur un thème autre que ceux indiqués ci-dessus sont encouragés à le faire dans le cadre d'un symposium « général ».

Soumission d'une communication régulière

Veuillez soumettre votre (vos) communication(s) originale(s) complète(s) au Comité du programme technique en utilisant le processus de soumission en ligne sur notre site web à http://www.ccece2012.org avant le 7 janvier 2012. Cliquer sur « Appel de communications » et suivre les instructions fournies.

Soumission d'une proposition de séance didactique et d'atelier

Les propositions de séance didactique et d'atelier d'une demi-journée devraient être soumises avant le 2 décembre 2011 au président en charge des séances didactiques à tutorials@ccece2012.org.

Dates importantes

Date limite des propositions de séance didactique ou d'atelier:	vendredi 2 décembre 2011
Date limite d'envoi de communication complète:	vendredi 7 janvier 2012
Date de notification d'acceptation :	vendredi 24 février 2012
Date limite d'inscription des auteurs :	vendredi 9 mars 2012
Date limite d'inscription anticipée :	vendredi 30 mars 2012

Expositions industrielles et parrainages

Pour les expositions industrielles, veuillez contacter le président en charge des expositions industrielles à exhibits@ccece2012.org. Pour les parrainages, veuillez contacter le président en charge de ces dossiers à sponsorship@ccece2012.org.

Appel pour réviseurs, questions ou commentaires

Pour agir bénévolement comme réviseur, svp contactez les co-présidents du programme technique: Scott Yam (scott.yam@queensu.ca), Lacra Pavel (pavel@control.toronto.edu) et Gerry Moschopoulos (gmoschopoulos@eng.uwo.ca).

Pour toutes autres questions ou commentaires, svp contactez le président de la conférence: Amir G. Aghdam. Ph: 514 848-2424 Ext. 4137, Fax: 514 848-2802 Email: aghdam@ece.concordia.ca

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