# IEEE

## *Canadian Review*

### *La revue canadienne de l'IEEE*

# High-intensity Discharge Lamps

## Multi-user Interactive Surface using Computer Vision

## Integrated Onsite and Online Conferencing

**IEEE Canada**

# IEEE Canadian Review
# General Information

The *IEEE Canadian Review* is published three times per year. Its principal objective is to project an image of the Canadian electrical, electronics, communications and computer engineering professions and their associated academic and business communities to:

(i) Canadian members of IEEE;

(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:

| | |
|---|---|
| 1 - National Affairs | 5 - Power |
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| 3 - Industry | 7 - Computers |
| 4 - Education | 8 - Electronics |

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# Editorial / *Éditorial*

*Eric Holdrinet SMIEEE, Rédacteur en chef / Editor-in-Chief*

**T**his issue of the *IEEE Canadian Review* is very much about the senses. Our technical feature article is about the improvement of your visual environment: Lighting with High Intensity Discharge Lamps, with a focus on white light or daylight conditions emulation (p.10).

Another article adds audio to video with Truly Integrated - Onsite and Online - Conferences (p.15). A number of webconferencing products are offered in the marketplace; however they generally lack important features to be considered useable in a typical IEEE (technical) conference setting. If you are called to organize such events, as professional and IEEE member, this article will help you set up your criteria and show you how a satisfactory online+onsite performance can be achieved.

Let's add a tactile component with the winning project of the latest IEEE Canada TELUS Innovation Award (for undergraduate students): A Multi-user, Interactive Surface Using Computer Vision (p.20). We are very proud to open our pages to our student members who are distinguishing themselves at national and international events. Congratulations to this year's winners and their institution: Issa Al-Fanek, Sam Sadighi and Eric Louis from Concordia University (Montreal, Quebec).

You wish to know the sweet smell of success? Follow the footsteps of our fellow members, be they sporting this actual title of "Fellow" (p.6), realizing great things for the IEEE community (p.22), receiving an IEEE Canadian Foundation award (p.24), or winning an International Solar Decathlon competition (p.26). You can also be inspired by Dr. Monique Frize's new book *The Bold and the Brave* on women who overcame obstacles to reach new heights in science and engineering; read the interview by our reporter Jennifer Ng Ain Kin (p.27).

And finally, it's a bittersweet moment when a dedicated volunteer presents her report and thanks before taking on Past-Presidentship duties. Under that new role, Dr. Ferial El-Hawary will dedicate yet two more years to the community, and our new IEEE Canada President Dr. Om Malik offers his thoughts in his first column for the Review.

I wish you a good Winter '10, and plenty of medals for Canada at the Vancouver Olympics.

**C**e numéro de *la Revue canadienne de l'IEEE* est vraiment à propos des sens. Notre article technique principal se penche sur l'amélioration de votre environnement visuel: l'éclairage par lampes à décharges à haute intensité, avec un focus sur la lumière blanche ou l'émulation des conditions lumineuses diurnes (p.10).

Un autre article ajoute l'audio au vidéo avec l'intégration réelle - sur place et en ligne - des conférences (p.15). De nombreux produits sont offerts sur le marché, mais généralement il leur manque des caractéristiques importances pour être utilisables dans un contexte typique de conférence IEEE (technique). Si vous êtes appelé à organiser de tels événements, en tant que professionnel et membre de l'IEEE, cet article vous aidera à déterminer vos critères et vous montrera comment une performance sur place + en ligne peut être atteinte.

Ajoutons une composante tactile avec le projet gagnant du dernier Prix d'innovation IEEE Canada TELUS (pour étudiants de premier cycle): Une surface interactive multi-usagers, utilisant la vision artificielle (p.20). Nous sommes très fiers d'ouvrir nos pages à nos membres étudiants qui se sont distingués à des événements nationaux et internationaux. Félicitations aux gagnants de cette année et leur institution: Issa Al-Fanek, Sam Sadighi et Eric Louis de l'Université Concordia (Montréal, Québec).

Vous désirez connaître le doux parfum du succès? Suivez les pas de vos pairs, qu'ils portent le titre de « Fellow » (p.6), aient réalisé de grandes choses pour la communauté de l'IEEE (p.22), aient reçu un prix de la Fondation canadienne de l'IEEE (p.24), ou remporté le Décathlon solaire international (p.26). Vous pourrez aussi être inspirés par le nouveau livre *The Bold and the Brave* de Dr. Monique Frize, sur des femmes qui ont surmonté les obstacles pour atteindre de nouveaux sommets en sciences et génie; lisez l'entrevue par notre reporter Jennifer Ng Ain Kin (p.27).

Et finalement, c'est un moment doux-amer lorsqu'une bénévole dédiée présente son rapport et remerciements avant d'entreprendre sa tâche de présidente sortante. Dans ce nouveau rôle, Dr. Ferial El-Hawary va dédier encore deux ans à la communauté, et notre nouveau président de l'IEEE Canada Dr. Om Malik offre ses pensées à sa première chronique dans notre Revue.

Je vous souhaite un excellent Hiver 2010, et plein de médailles pour le Canada aux jeux olympiques de Vancouver.

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## Table of Contents / *Table des matières*

Dear IEEE Canada Members,

2009 was a very busy and remarkable year that marked the 125th Anniversary of IEEE. I was invited by a number of IEEE Canada Sections to share in the celebrations: Northern Canada, Toronto, Montreal, Ottawa, Canadian Atlantic... In each case I was very pleased to speak and bring greetings on behalf of IEEE Canada and the IEEE Boards. All these events were well attended; see photos at http://www.flickr.com/groups/895777@N22/. The ad hoc History Committee led by Wally Read and Dave Kemp produced "A History of the Past 25 Years of IEEE Canada" in a printed brochure and archived the past 100 years of IEEE Canada's History at the Website. We are also looking forward to have your contributions to the History of IEEE Canada.

In September the Toronto Section celebrated this Anniversary, held its AGM, and had an IEEE Milestone Ceremony for the First External Cardiac Pacemaker at the occasion of the 2009 IEEE Toronto International Conference on Science and Technology for Humanity. IEEE Canada was exceptionally busy in Southern Ontario this Fall with an Executive Meeting, a Board Meeting, a Graduates of the Last Decade (GOLD) Congress, and the Annual IEEE Canada Student Branch Workshop led by Denard Lynch and April Khademi—a highlight of which was the IEEE Canada TELUS Innovation Award presentations to finalists.

At the Fall'09 Region Board Meeting, IEEE Canada established another ad hoc committee to investigate how it can provide more value, training and support to its Women-in-Engineering (WIE) members. This committee, chaired by incoming WIE Chair (Behnaz Ghoraani) with Katie Wright (CAS), Lori Hogan (Newfoundland & Labrador), Lesley McFarlane (Winnipeg), and Mazana Armstrong (Vancouver), will report at the 2010 Spring Meeting. Hopefully this will allow us to stir some action, get support for WIE similar to what is available to GOLD, attract and keep more members. A WIE congress in Canada, similar to the GOLD congresses, has been suggested. Earlier in the year the Board created and funded a Teacher-in-Service Program (TISP) committee chaired by Anader Benyamin-Seeyar, Montreal Section, who co-led last May a very successful TISP workshop with Raed Abdullah from the Ottawa Section.

Congratulations to our members who reached the grade of Fellow: Christophe Caloz, Norman Ross Chapman, Zhizhang David Chen, Aniruddha M. Gole, Maev Grigoryevich Roman, Leslie Ann Rusch, Christian Schlegel, Robert Schober, and Abdel A. Sebak. Congratulations as well to Ray Findlay and Amir Aghdam for receiving respectively the IEEE Haraden Pratt Award and the IEEE MGA Achievement Award.

It is gratifying to acknowledge volunteers who completed their term of office and welcome those who accepted to fill a position starting January 1st. I have enjoyed working with outgoing Area West Chair Lawrence Whitby and welcome him as incoming Membership Vice-Chair; the incoming Chair of Area West is Jeremy Gates. Keith Brown who completed his term of service Chair of Central Canada Area is now stepping into his new responsibility as IEEE Canada President-Elect. Welcome to Kash Husain as the new Central Area Chair; Kash completed his term as Chair of CONAC and is replaced by Sri Krishnan at this position. I also thank Amir Aghdam who completed his term as Eastern Canada Area Chair and accepted the task of Managing Editor, IEEE Canadian Review. The incoming Chair of Easter Canada Area is Wahab Almuhtadi.

Bob Alden completed his term as Chair of the Awards Committee and is replaced by Hussein Mouftah. We all owe Bob sincere thanks for his dedication to this responsibility and for the excellent job of establishing the IEEE Canada Web site as the main gateway for Awards. Rob Anderson served as IEEE Canada Treasurer for the past six years; our new officer in that role is Gerard Dunphy. Rob's excellence was duly noted: He will now be Treasurer of IEEE Member and Geographic Activities Board (MGA).

Finally, I take this opportunity to thank you all for your support and cooperation during my term of service and I look forward to work as Past President with Om Malik, President 2010–2011, and his team.

Chers membres de l'IEEE Canada,

2009 a été une année occupée et remarquable, soulignée par le 125e anniversaire de l'IEEE. J'ai été invitée par nombre de Section de l'IEEE Canada pour partager les célébrations: Northern Canada, Toronto, Montréal, Ottawa, Canada Atlantique... À chaque fois j'ai été heureuse de parler et saluer au nom de l'IEEE Canada et des Conseils de l'IEEE. Tous ces événements ont été très courus; voyez les photos à http://www.flickr.com/groups/895777@N22/. Le Comité ad hoc d'histoire, mené par Wally Read et Dave Kemp, a produit « A History of the Past 25 Years of IEEE Canada » en brochure imprimée et archivé les derniers 100 ans de l'histoire du IEEE Canada sur le site web. Nous espérons aussi obtenir votre contribution à l'Histoire de l'IEEE Canada.

En septembre la Section de Toronto a célébré cet anniversaire, tenu son AGA, ainsi qu'une cérémonie de Jalon IEEE pour le « Premier régulateur cardiaque externe » à l'occasion de la Conférence internationale IEEE 2009 sur la Science et la technologie pour l'humanité. L'IEEE Canada a été exceptionnellement occupé en Ontario du sud cet automne avec une réunion exécutive, une réunion du conseil, un congrès des Diplômés de la dernière décennie (DDD/GOLD), et l'Atelier annuel IEEE Canada des branches étudiantes mené par Denard Lynch et April Khademi – un point marquant ayant été la présentation aux finalistes des Prix Innovation TELUS de l'IEEE Canada.

À sa réunion du conseil de l'automne'09, l'IEEE Canada a établi un autre comité ad hoc pour déterminer comme nous pouvons procurer plus de valeur, formation et support à nos membres Femmes-en-génie (FEG/WIE.) Ce comité, dirigé par la nouvelle présidente WIE ((Behnaz Ghoraani) avec Katie Wright (Canada Atlantique), Lori Hogan (Terre Neuve & Labrador), Lesley McFarlane (Winnipeg), et Mazana Armstrong (Vancouver), fera rapport à la réunion du printemps 2010. Ceci devrait nous permettre de susciter du mouvement, et obtenir un support WIE similaire à ce qui est disponible à GOLD, et ainsi attirer et retenir plus de membres. Un congrès WIE Canada similaire à ceux de GOLD a été suggéré. Plus tôt cette année le Conseil a créé et financé un comité du « Teacher-in-Service Program » (TISP), dirigé par Anader Benyamin-Seeyar de la Section de Montréal, qui a co-organisé en mai avec Raed Abdullah de la Section d'Ottawa un atelier TISP qui s'est avéré un grand succès.

Félicitations aux membres qui ont atteint le grade de Fellow: Christophe Caloz, Norman Ross Chapman, Zhizhang David Chen, Aniruddha M. Gole, Maev Grigoryevich Roman, Leslie Ann Rusch, Christian Schlegel, Robert Schober, et Abdel A. Sebak. Félicitations aussi à Ray Findlay et Amir Aghdam pour avoir reçu respectivement les prix IEEE Haraden Pratt et « IEEE MGA Achievement Award ».

Il est satisfaisant de reconnaître les bénévoles qui ont complété leur terme et accueillir ceux et celles qui ont accepté d'occuper un poste à partir du 1er janvier. J'ai apprécié travailler avec le président sortant de la Zone Ouest Lawrence Whitby, et lui souhaite la bienvenue comme nouveau vice-président du développement des effectifs; le nouveau président de la Zone Ouest est Jeremy Gates. Keith Brown qui a complété son terme comme président de la Zone Centrale endosse maintenant la responsabilité de Président-élu de l'IEEE Canada. Bienvenue au nouveau président de la Zone Centrale, Kash Husain, qui a complété son terme de président de CONAC et a été remplacé par Sri Krishnan à ce poste. Je remercie aussi Amir Aghdam qui a complété son terme de président de la Zone Est et accepté la tâche de directeur de la rédaction de la Revue canadienne de l'IEEE. Le nouveau président de la Zone Est sera Wahab Almuhtadi.

Bob Alden a complété son terme comme président du comité des récompenses et a été remplacé par Hussein Mouftah. Nous devons tous à Bob de sincères remerciements pour son dévouement à cette responsabilité et l'excellent travail dans l'établissement du site web de l'IEEE Canada comme affichage principal pour les récompenses. Rob Anderson a été trésorier de l'IEEE les derniers six ans; notre nouvel officier dans ce rôle est Gerard Dunphy. L'excellence de Rob a été notée : Il sera maintenant trésorier du « IEEE Member and Geographic Activities Board (MGA). »

Finalement, je prends cette opportunité pour vous remercier tous pour votre support et votre collaboration durant mon mandat et j'attends avec impatience de pouvoir travailler comme présidente sortante avec Om Malik, Président 2010–2011, et son équipe.

**Dr. Ferial El-Hawary, P.Eng., F.IEEE, F.EIC, F.MTS**
2008-2009 IEEE Canada President and Region 7 Director
http://www.ferial.ca

Dear members: Having just started my term of office, I wish to express my thanks for the opportunity to serve you and the community. It is also an appropriate time to thank Bob Hanna who completed his six years on the Board, Ferial El-Hawary for her service during the past four years, and to welcome Keith Brown as President-elect 2010–2011. I look forward to working with them.
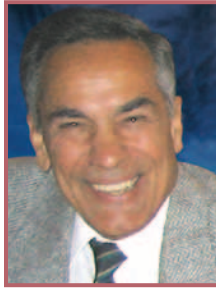
I conveyed my goals for 2010 in the January issue of the e-Newsletter that goes to all members in Canada. I look forward to your partnership and cooperation in achieving these goals, as I cannot accomplish much just by myself. "No man is an island..." sums up my approach.

Among the subjects that are engaging IEEE at present, I wish to bring the following to your attention:

- To meet the challenges that lay ahead after the devastating earthquake in Haiti in January 2010, IEEE has established the IEEE Haiti Engineering Educational and Professional Development Rebuilding Fund. Contributions to the Fund can be made on-line via http://www.ieee.org/foundation or by check to the IEEE Foundation. Leading the way, Northern Canada Section donated $2,500.

- The IEEE Board is in the middle of extensive discussions to transform itself and decouple from the operating units such as MGA, TAB, etc. Should this be approved by the Board at its February 2010 meeting, it will require amendments to the IEEE Constitution that will be submitted to the Membership for approval with the next election ballot.

IEEE offers a number of programs and services that are of benefit to the Members. It is worthwhile to keep track and take part in them. Recent additions include:

- Starting February 2010, IEEE Members will have access to over 200 e-books on IEEE Xplore. The collection will span a number of today's technologies in areas that include practical handbooks, introductory and advanced textbooks, reference works and professional books.

- An improved Internet video watching experience is available on the new IEEE.tv website, with over 130 videos currently part of the library.

- IEEE Routinely offers webinars on various topics of interest, such as an upcoming IEEE GOLD webinar on February 17 titled "Two Brains are Better than One: Right-Brain Leadership for Projects". Registration is easy.

- All Members who renewed for 2010 will receive free access to one of the following e-books: "Engineering the Art of Negotiation", "Survivor Planning", and "Communicating with Congress." Details coming in March.

Many other programs that benefit IEEE Members are available, including life, auto, and house insurance. I encourage you to take advantage of the IEEE Member benefits.

In closing: I look forward to working with you, and am always open to your comments and suggestions. Please send them at maliko@ieee.org.

Chers membres : Alors que j'entame mon mandat, je désire exprimer mes remerciements pour cette opportunité de vous servir ainsi que la communauté. C'est aussi une occasion appropriée pour remercier Bob Hanna qui a complété ses six ans au Conseil, Ferial El-Hawary pour son service au cours quatre dernières années et accueillir Keith Brown comme président-élu 2010–2011. J'anticipe avec plaisir de travailler avec eux.

J'ai publié mes objectifs pour 2010 dans le numéro de janvier du Bulletin électronique qui va à tous les membres de l'IEEE au Canada. J'espère votre collaboration dans l'atteinte de ces objectifs, car je ne pourrai accomplir grand chose par moi seul. « Aucun homme n'est une île... » résume mon approche.

Parmi les sujets qui occupent l'IEEE ces jours-ci, j'aimerais porter les suivants à votre attention :

- Pour relever les défis qui se présentent suite au tremblement de terre dévastateur à Haiti en janvier 2010, l'IEEE a établi le « IEEE Haiti Engineering Educational and Professional Development Rebuilding Fund. » Les contributions au fonds peuvent se faire en ligne via http://www.ieee.org/foundation ou par chèque à la Fondation de l'IEEE. Montrant l'exemple, la section Nord du Canada a donné 2 500$

- Le Conseil de l'IEEE est en cours de grandes discussions pour se transformer et se découpler des unités operationnelles telles le MGA, TAB, etc. Si c'est approuvé par le Conseil à sa réunion de février 2010, cela nécessitera des amendements à la Constitution de l'IEEE qui seront soumis pour approbation aux membres lors du prochain scrutin.

L'IEEE offre plusieurs programmes et services qui bénéficient aux membres. Ça vaut la peine de les connaître et d'y participer. Les additions récentes incluent :

- À partir de février 2010 les membres de l'IEEE auront accès à plus de 200 e-livres sur IEEE Xplore. La collection couvrira plusieurs technologies contemporaines dans des domaines qui incluent des manuels pratiques, de base ou avancés, des ouvrages de référence et des livres professionnels.

- Un service amélioré de vidéo Internet sera disponible sur le nouveau site web IEEE.tv, avec plus de 130 ouvrages actuellement disponible en vidéothèque.

- L'IEEE offre régulièrement des webinaires sur des sujets d'intérêt, tel le webinaire IEEE GOLD « Two Brains are Better than One: Right-Brain Leadership for Projects » qui sera présenté le 17 février. L'inscription est aisée.

- Tous les membres qui ont renouvelé pour 2010 recevront l'accès gratuit à un des e-livres suivants: « Engineering the Art of Negotiation », « Survivor Planning », et « Communicating with Congress. » Les détails suivront en mars.

Plusieurs autres programmes avantageux pour les membres de l'IEEE sont disponbles, incluant les assurance vie, automobile et habitation. Je vous encourage à en tirer avantage.

En terminant, j'anticipe avec plaisir travailler avec vous, et suis toujours ouvert à vos commentaires et suggestions. Veuillez me les faire parvenir à maliko@ieee.org.

<div align="center">

**Dr. Om Malik, P.Eng., LFIEEE, FEIC**
2010-2011 IEEE Canada President and Region 7 Director

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# *IEEE Humanitarian Initiatives*

Recent events in Haiti have touched the hearts of a multitude of people. Many engineers are asking themselves how they can contribute to rebuild the core capacities of this nation. As Dr. Om Malik notes above, to this end, IEEE has established a Haiti Engineering Educational and Professional Development Rebuilding Fund, where IEEE will match the first US$50,000 in donations; see http://www.ieee.org/foundation.

Another way to get personally involved as an engineer is to participate in the IEEE-United Nations Foundation Humanitarian Technology Challenge (HTC, http://www.ieeehtc.org).

It aims to develop implementable technological solutions to key challenges in reliable electricity, data connectivity of rural District health offices, and individual ID tied to health records.

As well, IEEE is sponsoring a Regional Student Design Competition, running from October 2009 to May 2010, for solutions to one of three humanitarian problems proposed by the HTC. Students must provide a working prototype, scale model, or detailed engineering design specifications addressing one of the three challenges.

IEEE Canada is allocating up to $5,000 for participation of at least one representative at each of the two HTC workshops to be held in 2010. If you are interested in the HTC effort contact Gerard Dunphy <g.dunphy@ieee.org> and Alfredo Herrera <alherrer@nortel.com>. Further information is available at www.ieee.org/web/volunteers/tab/htc/.

# *IEEE 125th Anniversary Celebrations across Canada*

A number of Sections in Canada celebrated the IEEE's 125th Anniversary by holding special events. Ferial El-Hawary, IEEE Canada President, made presentations at many of those on IEEE Canada's history and member contributions to technological historic milestones. She was in Montreal last November for such an event; her presentation was twinned with another one on IEEE Milestones - with a Canadian accent - by this magazine's Editor-in-Chief.

Ottawa Section marked the occasion by cutting a cake in February at the IEEE Student Branches' Connects event, followed in September to November with special seminars by the Photonics and EMBS chapters. On November 4th, the Section's historian Life Fellow, Dr. David Coll made a presentation titled "The History of IEEE Member Contributions to Science and Engineering in the Ottawa Area" - befittingly at the Canada Science and Technology Museum.

On July 14, the North Saskatchewan IEEE GOLD Committee with support from the Section and the IEEE STEP program hosted its annual Industry Barbecue for IEEE members and recent university graduates. This year, even with uncooperative weather, 75 people attended and 17 companies were represented. The IEEE 125th was celebrated with—what else?—a cake, a commemorative plaque, and presentations by Jeremy Gates, Section Chair and Andrew Kostiuk, Membership Development chair.

Northern Canada Section held a special "IEEE 125th" Dinner September 24, presented awards and looked back at impressive local contributions to technology fields such as radar, flat panel displays, and many others. Then a 180° turn with a keynote speech on future advances in technology by Dr. Axel Meisen, Chair of Foresight, Alberta Research Council.

Kitchener/Waterloo Section was a major sponsor, and the IEEE Student Branch at the University of Waterloo was the main organizer of the "First Year Engineering Competitions" on October 17, 2009. This event consisted of five competitions in engineering design spanning several disciplines, from robotics to rockets, windmill and bicycle design. This was the occasion to promote the IEEE with the perspective gained by its 125th Anniversary celebrations, distribute promotional material and membership packages. A short clip of the event can be seen at www.ieeekw.com/events/firstyearcompetition09/. In addition, the Section collected and published on its website its newsletters dating from 1973.

And finally, on November 19th, London Section hosted two keynote presentations at its AGM: "The History of IEEE and Electrotechnologies" by Maike Luiken, with material from the IEEE History Center, and "From Radio Astronomy to Image-guided Surgery" by Dr. Terry M. Peters, IEEE Fellow and Professor at the University of Western Ontario.

Long live the IEEE, and especially its members and volunteers.



*Happy guests at the North Saskatchewan Industry BBQ*



*Dr. Axel Meisen, Alberta Research Council, delivers his keynote presentation*

**IEEE Fellows**
*Canada - Class of /Classe de 2010*

Christophe Caloz
École Polytechnique, Montréal
*for contributions to the development and application of electromagnetic metamaterial structures*

Norman Ross Chapman
University of Victoria
*for contributions to geoacoustic characterization of ocean bottom environments*

Zhizhang David Chen
Dalhousie University, Halifax
*for contributions to time-domain electromagnetic modeling and simulation*

Aniruddha M. Gole
University of Manitoba, Winnipeg
*for contributions to the modeling of power electronics apparatus*

Maev Grigoryevich Roman
University of Windsor
*for contributions to high-resolution imaging, acoustic microscopy, and advanced material characterization*

Leslie Ann Rusch
Université Laval, Quebec, QC
*for contributions in optical and wireless communications systems*

Christian Schlegel
University of Alberta, Edmonton
*for contributions to iterative demodulation and decoding in wireless communication*

Robert Schober
University of British Columbia, Vancouver
*for contributions to wireless communications*

Abdel A. Sebak
Concordia University, Montreal
*for contributions to electromagnetics scattering, and design and modeling of antennas*

# IEEE EPEC 2010
## Annual Electrical Power and Energy Conference

### August 25-27, 2010, Halifax, NS, Canada

The annual IEEE Electrical Power and Energy Conference (EPEC 2010) will take place August 25-27, 2010 in Halifax, Nova Scotia, Canada. Located on the coast of the Atlantic, Halifax has one of the best Living Histories in Canada with countless festivals and events. First-rate facilities combined with succulent seafood and a cosmopolitan flair make it a unique and unforgettable meeting and convention destination.

The objective of EPEC 2010 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 of these fields, and to seek direct cross-fertilization in these areas. Special sessions will be organized. We will also invite renowned experts to give keynote speeches. Bring your research findings along with your family to EPEC 2010, enjoy our programs and appreciate the natural wonders of Halifax.

### *Topics*:

#### The topics of interest include, but are not limited to the following:

- Computational Intelligence Systems
- Electricity Markets
- Energy Storage
- Wind Power
- Smart Grid
- Computational Methods in Power System
- Transmission and Distribution

- Solar Power
- Microgrids
- Wave & Tidal Power
- Power System Communications
- Hydrogen Power
- Energy Systems for Buildings
- Bio-thermal Power

- Energy Conservation and efficiency
- Small Hydro Power
- Technology Trends
- Fuel Cells
- Clean & Renewable Energy Markets
- Novel Power Generation

### *Paper Submission:*

The format of the paper should follow the IEEE conference papers style. EPEC 2010 will only accept the electronic submission of full papers in English with a maximum six pages. Proceed on-line by uploading the PDF-format file to http://www.ieee.ca/epec10/. Detailed information on paper format and submission procedure can be found on the conference web site. Extended versions of accepted papers would be considered for the publication in an international journal as a special issue or in book chapters. EPEC 2010 proceedings are included in Compendex, IEEE Xplore and ISI Proceedings.

#### Important Dates:

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| April 1, 2010 | Submission of full papers in PDF and organized session proposals |
| May 1, 2010 | Submission of tutorial and workshop proposals |
| May 15, 2010 | Notification of paper and tutorial/workshop acceptance |
| June 10, 2010 | Submission of final camera-ready papers |

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 detailed up-to-date information, please visit the EPEC 2010 conference web site:
### http://www.ieee.ca/epec10/

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# Canadian Newslog / Coupures de presse canadienne

**Newslog Editor**

**Rédacteur des Coupures de presse**

Alexandre Abecassis is a patent agent and Partner at Fasken Martineau DuMoulin LLP, Lawyers and Patent and Trade-mark Agents.

*Alexandre Abecassis est agent de brevets associé chez Fasken Martineau DuMoulin S.E.N.C.R.L., s.r.l., Avocats et agent de brevets et de marques de commerce.*

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*Veuillez faire parvenir les coupures de presse proposées par e-mail à alexandre.abecassis@ieee.org*

MONTREAL, QC. Sep. 14, 2009. Dialogic announced the release of a product that will deliver new levels of Signaling System 7 (SS7) scalability and integration. The capabilities introduced by the new product release are intended to enable service providers to reduce operating expenses associated with network equipment as well as an effective cost support of the innovative mobile services.

OTTAWA, ON. Nov. 26, 2009. March Networks announced that it has been selected to offer a video surveillance solution for the legislative assembly of Utta Pradesh, India. Videos will be obtained from multiple dome cameras, installed throughout the site. The solution offered will enable centralized security personnel to monitor in real-time activity and to track any incidents. An IP-based network is used in the solution for sharing video data and the video data is stored in servers running a dedicated application.

MONTREAL, QC. Nov. 17, 2009. Nstein Technologies announced the release of a front-end, multi-index search engine. The search engine uses a text-mining technology in order to drive a site search which returns results that are organized categorically. More precisely, the search engine is capable of identifying concepts, categories, proper names, etc. Documents are annotated using that information. It is possible to derive underlying nuances as well as content meaning of a document using such solution.

TORONTO, ON. Nov. 11, 2009. Iseemedia announced that it has started deploying an SMS-based push-mail service with Tata Indicom and Tata Docomo. The SMS-based push-mail service supports various emails systems such as Microsoft Hotmail, Gmail, Yahoo! as well as other business email platforms. The service has been designed to serve enterprises as well as consumers in India. Tata Teleservices is the fastest growing mobile operator of India and is serving more than 50 million subscribers.

MONTREAL, QC. Oct. 27, 2009. Alphinat announced that it has been selected together with a partner by the "Direction Générale de la Modernisation de l'État" (DGME) of the French Republic for ensuring the implementation of the new on-line government/citizen applications reform. The "Direction Générale de la Modernisation de l'État" has defined a program for putting administrative procedures online. This e-government initiative requires the implementation of a generic platform enabling design, production and implementation of online administrative processes for citizen-centric services. The service oriented architecture approach used enables the leveraging of existing applications and the development of new e-services.

MONTREAL, QC. Sep. 23, 2009. Irosoft announced that it has signed a contract with the Government of Bermuda. The contract signed is for the installation of a software, also referred to as a Legislation Information Management System, for the drafting, consolidation and publishing of statutes and regulations. It will be used by, inter alia, citizens of Bermuda to facilitate access to the laws of that country. It is already used by a couple of agencies in Canada.

TORONTO, ON. Nov. 11, 2009. Sirit, a provider of radio frequency identification ("RFID") technology, announced that it has installed an electronic toll along the Devimed Toll Road in Medellin, Colombia. The system will be used by over 24,000 daily users. This system is the second electronic toll installation for Sirit in Colombia.

MONTREAL, QC. Nov. 4, 2009. Bombardier Recreational Products (BRP) announced that it has been awarded a $10 million US contract from the United States Marine Corps for its Evinrude multi-fuel engines. The flexible fuel engine is designed for being able to withstand multiple fuels in harsh demanding mission applications and is capable of running on kerosene, aviation fuels as well as on standard gasoline. A switch is actuated for changing the fuel selection.

MONTREAL, QC. Oct. 12, 2009. Aldea solutions announced that they have been selected by TVN Chile television channel for the transmission of the FIFA World Cup in South Africa 2010. Aldea will provide HDTV video transport services from TVN studios in Johannesburg to Santiago, Chile during the soccer event. The transport of the data will be performed over optic fiber.

EDMONTON, AB. Oct. 1, 2009. The chief executive officer of Madentec Limited and Cleankeys, M. Randy Marsden, received the Alumni Honor Award at the 2009 Alumni Recognition Awards for the University of Alberta. M. Randy Marsden has founded in 1989 Madentec, a company which provides alternative computer input solutions. For instance, recently, Madentec invented an aseptic keyboard that can be cleaned and disinfected in less than 10 seconds. Such keyboard may advantageously be used for instance in dental offices or in hospitals.

QUEBEC CITY, QC. Nov. 10, 2009. EXFO announced the release of a new end-to-end solution for IP video service assurance. The solution developed is an end-to-end solution that supports service assurance from installation to monitoring and ongoing troubleshooting. The solution provides an open service assurance environment built on a common platform for voice, video as well as data networks.

MONTREAL, QC. Oct. 13, 2009. Pascal Pilon and Richard Maltais, who are respectively chief executive officer and chief operating officer of Averna, won the Ernst & Young Entrepreneur Of The Year 2009 Quebec Award, Technology category. Averna is a global test engineering solutions company and a strategic partner for OEMs. Averna was founded one decade ago.

MISSISSAUGA, ON. Aug. 25, 2009. Siemens Building Technologies have been selected by the Humber College Institute of Technology & Advanced Learning for providing an integrated security system for its North Campus located in the northwest part of Toronto. The solution will replace the existing fire alarm system with a fully-addressable solution having annunciating capabilities. There are over 1,900 detection devices and 2,100 speakers and strobes throughout the campus.

VANCOUVER, BC. Nov. 24, 2009. Emergeo Solutions Worldwide announced that it has been awarded a contract from the City of Vancouver. EmerGeo's software and services will be used in a federally funded project titled: "Integrating Situational Awareness: Publishing Alerts, Incident Information, Roadway Impacts, and Critical Infrastructure Data". The purpose of the project is to increase situational awareness within the City of Vancouver and help the Vancouver Office of Emergency Management achieve its vision of a disaster-resilient Vancouver ❖

## Patentable Inventions — Comments Sought by CIPO

The Canadian Intellectual Property Office is revising some chapters of its Manual of Patent Office Practice, and is asking for comments from patent examiners, patent professionals, as well as the general public.

Chapter 9 - "Descriptions" has been revised and is in draft format. Chapter 16 - "Computer implemented inventions" will be open for feedback some time this Spring. These two chapters are intended to direct patent examiners in, among other things, their assessment of what types of inventions are fundamentally patentable or not. Therefore, the guidance and instruction provided by these chapters will have a great effect on any innovators seeking a patent in Canada, as well as any innovators who may be affected by someone else's patent. See http://www.opic.ic.gc.ca/eic/site/cipointernet-internetopic.nsf/eng/wr00758.html

# A View from the West

On: Retirement (or not), Canadian Innovation, Capturing CO2, BC Corporations and Headhunters, Alberta Venture, Innovation and Wind Power, Saskatchewan Business, Manitoba's Fastest.

*By    Terrance Malkinson*
*School of Health and Public Safety*
*SAIT Polytechnic. Calgary, Alberta*

◆ Working well past traditional retirement age; full-time, part-time, or in a phased retirement plan is forecasted to be the new norm in employment. "Retirement: Sixty and Clout" (available on www.canadianbusiness.com, originally published in MoneySense) by David Aston provides strategies on how to find a job that will make your senior years truly golden.

◆ A series of articles on opportunities for Canadian innovation is provided in "Ideas and Innovation - 2009" (The Globe and Mail's Report on Business. 25(11):41-47. June, 2009. www.theglobeandmail.com/report-on-business/rob-magazine). A series of articles on products that the authors believe the world needs. These include better batteries, local news providers, innovations in 3-D movie technology, and micro-manufacturing. - An overview of business prospects for Canada is provided in "Outlook" (Canadian Business. 82(16):11-18, September 28, 2009. www.canadianbusiness.com ). A series of articles discuss issues of current interest such as the Canadian dollar, Canadian innovation, real estate, and the economy. - The Science and Technology Innovation Council's 64-page report to the Ministry of Industry ("State of the Nation 2008: Canada's Science, Technology and Innovation System" is provided at www.stic-csti.ca and a commentary on Canada's Innovation Deficit originally published in Policy Options June, 2009 is provided at www.mcgill.ca/files///principal/CanadasInformationDeficit.pdf. The data indicates that Canada experiences low business R&D, poor business-university collaboration and Canadian universities lack international visibility. The need for Canada to develop its talent, leadership a coherent and robust vision for innovation is emphasized.

◆ Capturing CO2 is thought to be important in the plan to fight climate change. Matthew McClearn discusses the topic from the Canadian perspective and how it will not be cheap or easy in "Carbon Crapshoot". (Canadian Business. 82(14/15): 35-39. September 14, 2009. www.canadianbusiness.com).

◆ An overview of the British Columbia economy and a listing of the top British Columbia private, public and crown corporations are provided by Peter Mitham in: "Top 100 Companies 2008" (BCBusiness. 37(7):111-139. July, 2009. www.bcbusinessonline.ca). Leading the list are two public corporations, Telus and Teck Resources Ltd, followed by private company Jim Pattison Group. Other rankings by sector and performance indicator are also provided.

◆ Executive head-hunters are in the business of finding the most talented people for the job. In "Big Game Hunter" (BC Business 37(8): 26-29, August, 2009) Miguel Strother describes the experiences of a Vancouver based headhunter. An interesting inset provides tips on how you can attract the attention of headhunters.

◆ The Alberta Venture survey "V-100" (Alberta Venture. 13(9):35-62, September, 2009. www.albertaventure.com ) provides an overview and listing of the top companies in Alberta and a discussion on how the leaders have found opportunities to gain a competitive advantage in challenging economic times. Energy giants such as EnCana, Imperial Oil, and Suncor lead the ranking.

◆ Perspectives on what's right and wrong with Alberta's innovation system are provided in "Innovation Report - 2009". (Alberta Venture. 13(10), October, 2009). Michael McCullough interviewed Doug Horner, Patrica Glenn, John Fallavollita, and Bruce Alton.

Continuing on in the same issue "Far Out" (pp. 36-37) looks at seven hascent technologies that are seen to have commercial potential for development in Alberta. - Stephanie Sparks in her article "Inside the Idea Factory" (Alberta Venture. 13(10): 39-43, October 2009) discusses practices for innovation by Calgary based Mentor Engineering. This is a business that started in a basement of one of its three founders and now has 124 employees in a 22,000 square foot facility that yields a half dozen new products a year.

◆ Benjamin Freeland discusses how wind power is attracting billions of dollars of investment and transforming the landscape of southern Alberta in "A Mighty Wind" (Alberta Venture. 13(8):40-44, August, 2009). Many important issues associated with this source of energy are provided by the author Benjamin Freeland.

◆ Harley Hotchkiss CC, a noted Calgary philanthropist, businessman in the petroleum industry, co-owner of the Calgary Flames Hockey team, donated $39M for neurological research at the Hotchkiss Brain Institute (www.hbi.ucalgary.ca), University of Calgary. This follows an initial gift of $10M donated in 2004 to establish the Institute, a centre of excellence in neuroscience and mental health research. Its mission is to support and conduct research on the healthy and diseased brain, spinal cord and peripheral nerves assessing, understanding and disseminating knowledge about the diseases affecting the nervous system.

◆ The 26th edition of Saskatchewan's Top 100 Companies is provided in Saskatchewan Business Magazine. (30(6): 11-23, September 2009). Leading the ranking is PotashCorp and Federated Co-operatives Limited followed by Viterra Inc. The author Paul Martin provides a discussion of highlights and challenges of 2008. Profiles of leading companies are also provided. - Stories of the Saskatoon non-profit business incubator, Ideas Inc. and its vision for the future are discussed by Keith Moen in "Bright Idea" (Saskatchewan Business Magazine" 30(4): 5-9. June 2009). The business model was conceived by, planned, and operated by Saskatoon's business community which provides for a comprehensive network of business resources that can be called upon to assist clients. - A profile of a Saskatoon website strategy, design and development, social media and mobile applications company is provided in "A Room with a Zu" Saskatchewan Business Magazine. 30(5): 9-13. July/August, 2009. Keith Moen discusses the work of the two business partners of this 15-year old Saskatoon based company who are seen as pioneers in the website industry.

--- *About the Author* ---

**Terrance Malkinson** is a communications specialist, business analyst and futurist. He is Vice-Chair of the IEEE-USA Communications Committee, an international correspondent for *IEEE-USA Today's Engineer Online*, editor-in-chief of *IEEE-USA Today's Engineer Digest*, and an associate editor for *IEEE Canadian Review*. He was an elected Senator of the University of Calgary and an elected Governor of the IEEE Engineering Management Society, as well as an elected Administrative Commitee member of the IEEE Professional Communication Society. He has been the editor of several IEEE conference proceedings, and past editor of *IEEE Engineering Management*. Currently, he is with the School of Health and Public Safety/Applied Research and Innovation Services at SAIT Polytechnic in Calgary.
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# High-intensity Discharge Lamps: a Review

## 1.0 Introduction

**L**ight sources are used in a number of applications and can be designed to generate an optical spectrumz that is tailored to the user's needs, spanning the infrared, visible and ultraviolet region. The current uses of light sources include general residential and commercial lighting, street/industrial lighting, automotive headlamps, video projection (UHP lamp), floodlighting, sun tanning, microscopy, endoscopy, photochemistry, lithography, green houses, etc.

Lighting plays a fundamental role in our lives. Lighting loads consume approximately 20% of the energy produced by electrical generating sources connected to the electrical grid. Hence there are societal pressures to find light sources that use less electrical energy to produce the same amount of light. The efficiency of light production varies depending on the type of lamp that is used.

A lamp system is comprised of an electronic ballast, a lamp and a luminaire. The electronic ballast converts the incoming ac utility power into a voltage and current which are compatible with the proper operation of the lamp and also compliant with the utility regulatory requirements. The luminaire receives the light generated by the light source and directs it to a designated location; the light is spread out uniformly and/or is concentrated in one area.

Figure 1 shows a comparison of the efficacies of various lamps over the past one and a half centuries. The standard fluorescent lamp and the incandescent lamp, which is being phased out in some jurisdictions, are used for applications at relatively low lumens level. The sodium lamps, which are typically very efficient, produce most of their color in the yellow part of the spectrum. Consequently, they are used primarily for street lighting and are not used to emulate daylight. For at least two decades, despite all the science and technology advances in the lamp field, the maximum radiative efficiency of the lamps for the production of white light has been stagnating around 120 lm/W.

Figure 2 shows the efficacy for the whole system taking into account each component: the ballast, the lamp and the luminaire. This figure shows a comparison of system efficacy for most of the lamp types that are currently on the market. Values in the leftmost column report the range of efficiencies for ballasts and electronic drivers. Values in the central column report efficacies for different lighting devices. The values in the third column report ranges of fixture efficiencies. The values in the rightmost column report the overall system efficacies of lighting systems.

By Amgad Eldeib[1], F. P. Dawson[1], G. Zissis[2] and S. Bhosle[2]

[1] Department of Electrical and Computer Engineering, University of Toronto

[2] LAPLACE Laboratory, LED Engineering Development, Université Paul Sabatier, Toulouse, France

### Abstract

This paper presents the basic science and the operating principles of a high intensity discharge (HID) lamp. The focus is on HID lamps that are used to emulate white light or daylight conditions. A review of the electrical requirements for operating a HID lamp is provided, and the class of ballasts that can be used to such end. An HID lamp requires an igniter to start the lamp and a power source to sustain the electrical discharge; this source should be designed to avoid acoustic resonances.

### Sommaire

Cet article présente la science fondamentale et les principes directeurs d'une lampe à décharge à haute intensité (DHI). Nous nous penchons sur les lampes DHI utilisées pour reproduire la lumière blanche ou la lumière du jour. Nous examinons les exigences électriques pour faire fonctionner une lampe HID, et la catégorie de ballasts qui peuvent être utilisés à cette fin. Une lampe HID requiert un allumeur pour démarrer la lampe et une source d'énergie pour maintenir la décharge électrique; cette source devrait être conçue de façon à éviter les résonances acoustiques.

Light sources for illumination must satisfy the following requirements: they must have an acceptable color correlated temperature (CCT) where CCT is related to the color of the light source. Objects that are illuminated by the source should provide a reflected color that is faithfully reproduced. The measure of how well the reflected color is perceived is referred to as the color rendering index (CRI). A CRI of 100 is considered the best and a lower number is considered worse. Finally, the power deposited in the lamp should not contain power harmonics at specific frequencies that the eye can detect as light intensity oscillations ("light flicker").
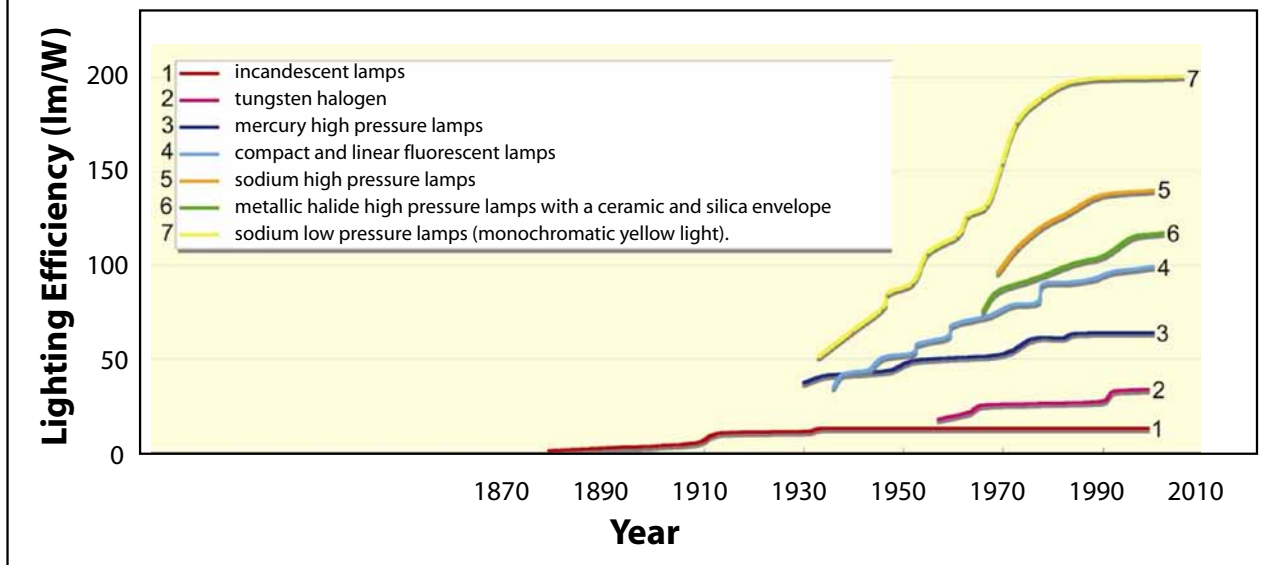


**Figure 1: Evolution of the electric lamp efficiency used for general lighting. Copied with permission [1]**

We will describe the operating principles of light sources used to provide general lighting, and in particular lighting at moderately high intensity. These light sources are referred to as high intensity discharge (HID) lamps, the most common types of which are mercury, metal halide, ceramic metal halide, sodium and xenon lamps. The first section gives a comparison of the different lamps used for lighting purposes with a special emphasis placed on HID lamps physics. We then review some difficulties posed by this type of lamp. The last sections examine the types of ballasts that are currently used to power HID lamps, and igniters.

## 2.0 HID Lamp Physics

Lamps are characterized in terms of containing either low pressure or high-pressure gas fills. Fluorescent lamps contain a rare gas mixture with a small amount of mercury at low pressure (typically much less than 1 bar.) The dynamics of the electrons typically dictate the electrical characteristics and the optical spectrum of the light in a low-pressure gas. The optical spectrum in low-pressure lamps typically consists of many emission lines, far removed from a blackbody spectrum. Phosphor deposited on the inside of the gas enclosure is used to convert the ultraviolet light spectrum from the lamp into a number of colors which, when taken together, are perceived as generating white light. The heavy particles suffer few collisions and thus remain at a cold temperature in contrast to the electrons. The amount of current passed by the lamps is limited due to the low gas pressure.

A HID lamp operates at higher pressures and has a different electrode structure compared to a fluorescent lamp [3, 4]. At higher pressures (near or above 1 bar), the heavy particles in the gas (atoms and ions) are subjected to many collisions, therefore the temperature of the electrons and the heavy particles tend to equalize and become quite large (between 5,000 and 7,500 kelvin). The result of this higher pressure is a different physics. The radiative efficiency over the near infrared, visible/ultraviolet region increases with pressure (which leads to higher temperatures) and more lumens can be generated from a smaller volume. The higher operating temperature and pressure dictate the need for a different lamp construction: they require an internal vessel optimized for temperature and optical transmissivity and an outer enclosure to protect users from the rupture of the internal enclosure. The space within the two enclosures is evacuated and may contain a getter to absorb residual contaminants. The minimization of contaminants is essential since the inner glass enclosure - which operates at very high temperatures - allows elements from the outside to diffuse inwards fairly easily. Any gas diffusing into the plasma would change the gas composition, and thus the optical characteristics of the discharge would change as well. In the case of HID mercury lamps, the inner surface of the exterior glass enclosure is coated in phosphor so as to convert the ultraviolet spectrum into white light.

The spectrum, which for a low-pressure system consisted of a few emission lines, begins to spread out as the pressure is increased and approaches a blackbody spectrum. HID lamps do not rely on a phosphor to convert ultraviolet light into visible light. UV radiation is trapped inside the discharge due to the density of the emitting media. Hence it is necessary to add specific metal halide salts such as sodium iodide, scandium iodide, indium iodide, thallium iodide or mixtures including rare-earth iodides such as dysprosium iodide, holmium iodide or thulium iodide to alter the spectrum and thus improve the correlated color temperature and color rendering index. On lamp start-up, the salts begin to sublimate. The initial color of the lamp on startup differs from the color achieved once the solids have sublimated. The construction of a metallic iodide ceramic lamp is shown in Fig. 3. The inner enclosure is constructed of a ceramic in order to operate the plasma at very high temperatures. The optical transmissivity of the inner or outer glass is designed to prevent the ultraviolet light from escaping from the lamp.

## 3.0 High Pressure Problems

One of the consequences of operating at high pressure is that the voltage required to generate an electrical discharge (plasma) is much higher in comparison with a low-pressure gas. Moreover, the voltage required to force ignition depends on the initial temperature of the plasma. For example, it is much more difficult to initiate a discharge if the lamp was initially operational, was turned off momentarily (for example during a power outage) and then turned on again - an event called "hot strike ignition voltage".
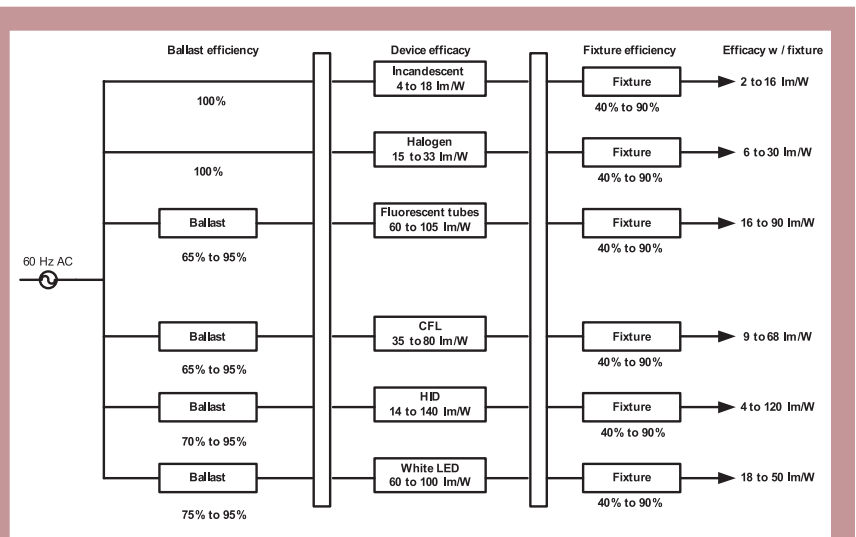


Figure 2: Efficacy of lighting devices and fixtures. (Adapted from [2] with a modification to the LED efficacy based on the projected impact of internal heating.)

Secondly, a gas at high pressure is subject to acoustic resonances. The resonance frequencies are a function of the gas temperature, the gas composition and the enclosure geometry. The frequencies shift if the lamp is dimmed (the temperature of the lamp changes) and as the lamp ages (the gas composition will change due to contaminants that leak into the lamp enclosure over time from the glass or the electrodes).

Figure 4 shows a generalized example of the acoustic resonance frequency spectrum. For larger lamps, implying higher power levels, the lowest order resonance frequency appears at lower frequencies. Conversely, for smaller lamps (lower output power) the minimum acoustic resonance frequency is shifted to higher frequency values [6].

HID lamps for lighting applications usually operate with an ac source in order to avoid cataphoresis, resulting in color variations along the axis of the lamp due to unequal diffusion rates of different species within the electrical discharge. The HID lamp draws a specific temporal current depending on the temporal voltage and operating frequency. The product of the voltage and current produces a power. Consider the application of a sinusoidal current source with a specific source frequency (an idealization): the power deposited into the plasma consists of a constant value and an oscillating component with a frequency that is twice the source frequency. This double frequency should not coincide with the acoustic resonance frequency otherwise the discharge will not assume a straight path between the two electrodes. Parts of the glass enclosure would be subjected to a high temperature while other parts of the enclosure remained cool. This would cause a temperature gradient to exist along the periphery of the enclosure and eventually lead to catastrophic failure of the lamp due to thermal stress. Also, a hot spot could cause localized vitrification or damage to the glass enclosure; this



Figure 3: Ceramic metallic iodide lamp (150 W) (photo courtesy of SIP-CPAT) Copied with permission [1]

**Figure 4: Zones of HID lamp instability—Adapted from [5]**



**Figure 5:  Idealized representation of lamp current, lamp power and Fourier components of lamp power**

have become prevalent. Unfortunately, the power supply efficiency and electromagnetic interference concerns will become the overriding issue at such frequencies. Operation at low frequencies below resonance is not practical because of the size of the energy storage components.

Alternatively, the power source can be operated at low frequencies using a square wave current source (idealized case, Fig. 5). A square wave current source produces only a dc power component and thus acoustic resonances will not occur since they are not excited. In practice, it is not possible to generate a square wave current source; a trapezoidal waveform with fast rise times and fall times is produced instead. The first significant power harmonic occurs at twice the operating frequency, however the energy of this harmonic is not large enough to excite an acoustic resonance: it is below a threshold level. Practical designs have the converter operating at a frequency where the second harmonic is below a threshold value and less than the lowest first order acoustic resonant mode. The switching frequencies are typically between 200 and 900 Hz. This translates into a lowest order power harmonic between 400 and 1800 Hz; this is typically lower than the lowest order acoustic resonant mode.

## 4.0 Ballast Architectures

Ballasts are power supplies designed to satisfy the requirements of the lamp and those of the utility. There are three general approaches taken to powering a high pressure lamp (although there are small differences between various lamp types) [7]:

➤ Ballast type 1: Half bridge or full bridge resonant converter with external igniter.

➤ Ballast type 2: Half bridge or full bridge resonant inverter with integrated resonant igniter.

➤ Ballast type 3: Square wave current source and external igniter.

Typical architectures include a traditional 60 Hz ballast with built in igniter, a resonant power supply operating at tens of kilohertz with built in igniter for lamps of higher power rating (Fig. 6), a resonant converter that exploits the properties of resonance to produce ignition in lamps and nominal lamp power for lamps with a moderately low power rating and low ignition voltage (Figs. 7, 8) and a square wave source between 200 and 900 Hz with built in igniter (Fig. 9). Some switch-mode power supply architectures for steady state operation are detailed as follows:

In Figure 6 (Ballast Type 1) the converter is designed to operate with an igniter. The capacitor in series with the igniter's transformer prevents a dc bias from being applied across the lamp. It is also employed as part of a resonant circuit. Once the lamp ignites the impedance of the lamp becomes low and most of the current passes through the lamp. The circuit is then operated as a series resonant converter.

Figure 7 (Ballast Type 2) shows a half bridge converter, designed to operate at two frequencies and often referred to as a LCC series parallel inverter. Prior to ignition, the lamp appears as an open circuit and the operating frequency is adjusted to ensure ignition. Current is sensed in the lamp and is used in a feedback system to maintain constant power through the lamp. After ignition, the impedance of the lamp drops and the switching frequency is adjusted to maintain a specific lamp power.

The asymmetrical bridge LCC converter, shown in Figure 8 (Ballast Type 2) uses a commonly found power factor correction circuit on the front end. This converter architecture can generate enough voltage to trigger ignition as well as maintain a steady state discharge. The converter is designed to operate at two frequencies. Prior to ignition, the lamp
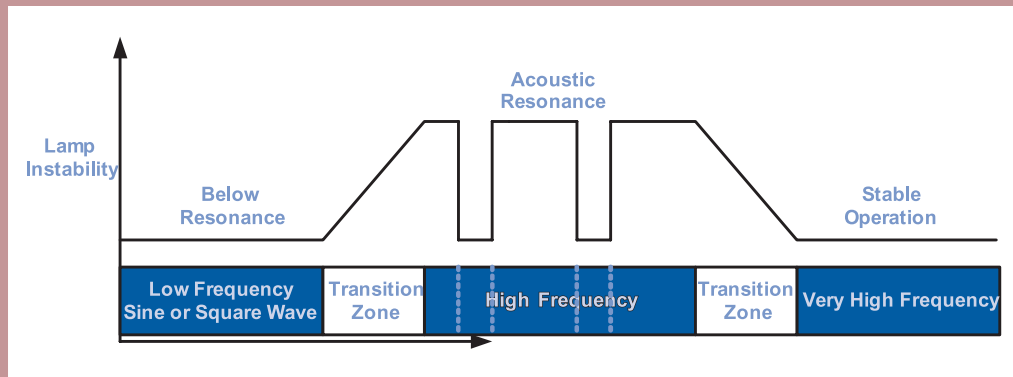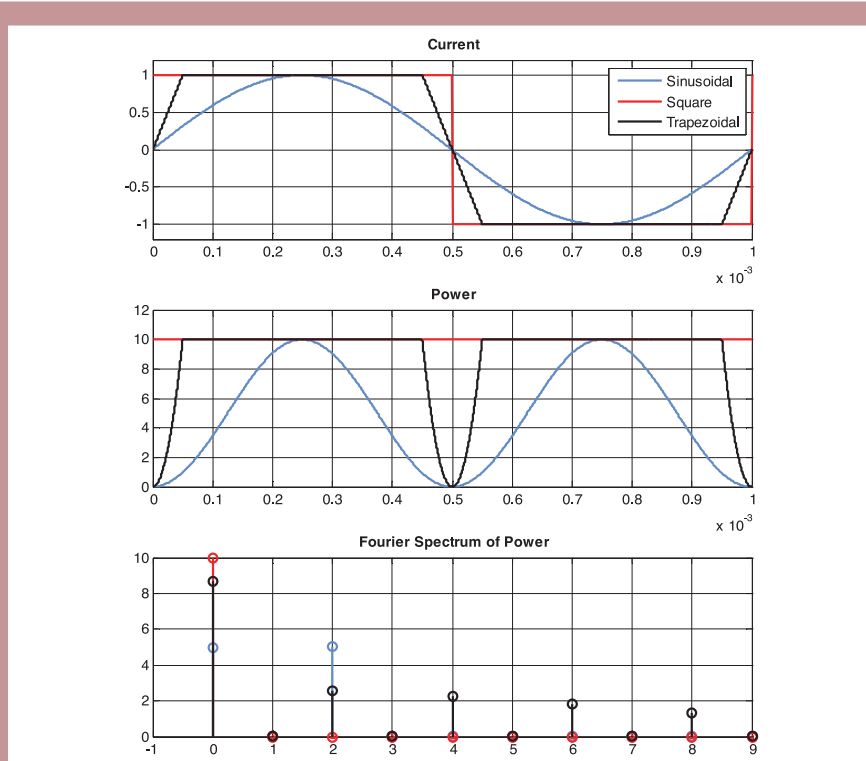
is cumulative and the lifetime of the lamp would be compromised.

This description is somewhat oversimplified, however the outcome of acoustic resonances is clear: the lamp fails destructively or the lifetime of the lamp is compromised. The generation of acoustic resonant modes should be mitigated. This can be practically accomplished in the following two ways:

➤ Apply a current waveform that results in either a single frequency power signal (double the excitation frequency) that avoids frequencies where instability occurs, or

➤ Apply a square wave current waveform (idealized case) that produces only a dc power component.

Consider first the case of single sinusoid excitation (Fig. 5). Operation within a narrow frequency window is plausible, however this permissible frequency window will change with lamp age and will vary from manufacturer to manufacturer. Moreover, dimming will alter the discharge temperature, which will move the frequency window. To remain within a frequency window requires intelligent sensing and control. Many attempts have been made to design such systems, but the reliability of these methods has not been demonstrated yet. On the other hand, operating above the problematic frequencies is possible since the threshold for a resonance to develop is higher, and thus acoustic damping mechanisms

**Figure 6:** (*Ballast type 1*) **HID electronic ballast; power factor correction and full bridge LCC resonant inverter circuit with external ignitor: Adapted from [7]**



**Figure 7:** (*Ballast type 2*) **HID half bridge inverter circuit with integrated resonant ignitor: Adapted from [7]**



**Figure 8:** (*Ballast type 2*) **HID electronic ballast: Asymmetrical bridge resonant inverter with integrated resonant ignitor and power factor correction: Adapted from [8]**
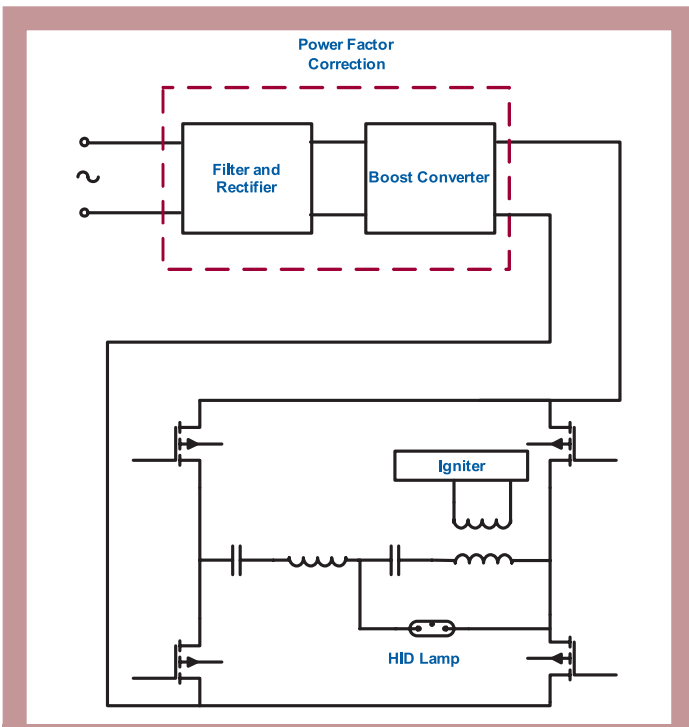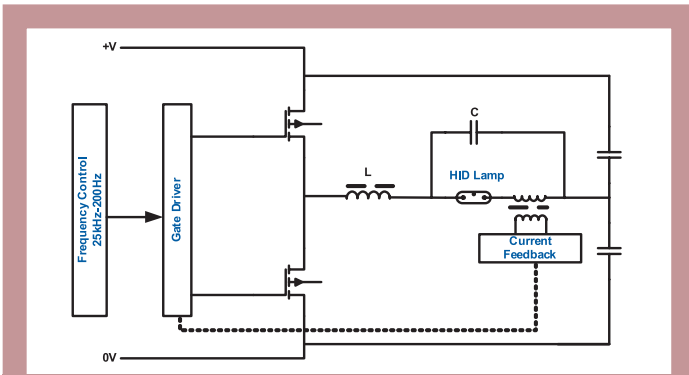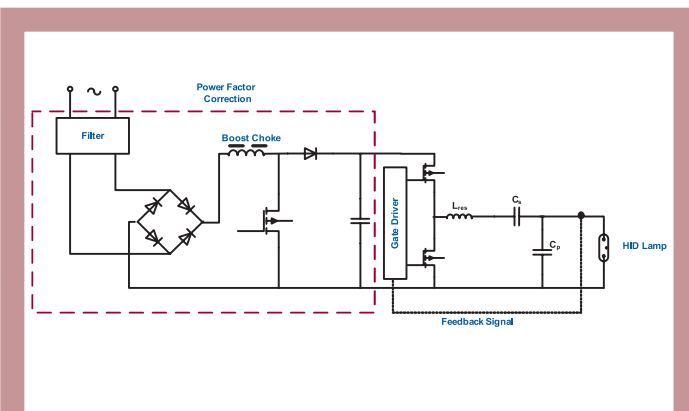
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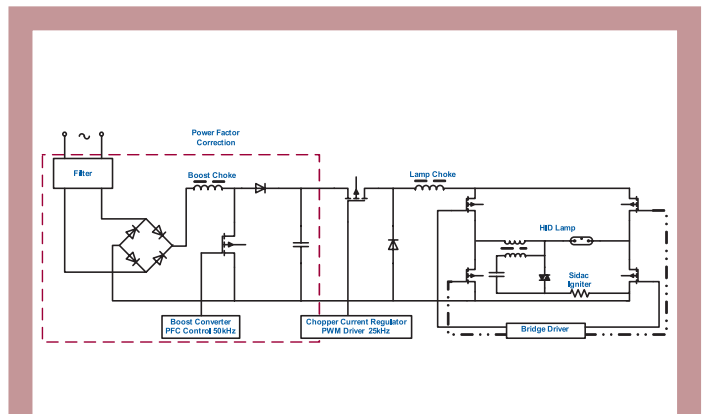


**Figure 9:** (*Ballast type 3*) **HID electronic ballast; power factor correction and constant current square wave modulation circuit: Adapted from [7]**

ignition, the impedance of the lamp drops and the switching frequency is adjusted to maintain a specific lamp power.

In Figure 9 (Ballast Type 3) the converter has a conventional power factor correction circuit followed by a controlled dc current source. The dc current is then inverted to produce a square wave current. A similar approach which places a capacitor across the inverter dc bus has been employed in [9] however the controller of the inverter is used to produce a square current output waveform to the lamp. An external igniter is used in this circuit. The inverter produces an ac square wave current with a frequency that can range between 200 and 900 Hz.

The move towards electronic ballasts is motivated by one or more of the following factors: decreasing the size of the power source, providing the ability to dim the lamp, maintaining constant lumen output over the lifetime of the lamp and responding to line voltage disturbances.

## 5.0 Igniters for HID lamps

High voltage, required to initiate the discharge in the HID lamps, is produced using special circuits called igniters. The three primary types of igniters on the market are [7]:

### 5.1 Parallel igniter

In this type of igniter, a capacitor and thyristor are placed in series with the ballast inductor. The LC parallel resonant circuit is tuned to allow a large voltage to occur across the capacitor. This capacitor voltage is discharged through the lamp. This type of igniter is only suitable for small lamps that require a voltage of about 800V. The schematic in Fig. 10a shows the connection of such an igniter.

### 5.2 Impulser Igniter

This igniter uses the same idea as the parallel igniter but it incorporates an autotransformer. This transformer is used to boost the voltage pulse to the kV range. This igniter has very low losses when the lamp is running but the autotransformer must be designed to withstand a high voltage. This adds to the cost and complexity of the system. The circuit diagram of this igniter is shown in Fig. 10b.

### 5.3 Superimposed Pulse Igniter

In this igniter, high frequency high voltage pulses are superimposed on the low frequency sinusoidal voltage. This igniter is the most common one in use. Its main disadvantage is that it is permanently in this circuit and therefore it contributes to ballast losses. A schematic is shown in Fig. 10c and a more specific igniter circuit is given in Fig. 10d.The igniter uses a SIDAC. The SIDAC has the properties of an avalanche diode: below a certain voltage the SIDAC is open circuit and above a certain threshold voltage the SIDAC breaks down and provides a low impedance path.

The voltage required to restart a lamp after it has operated for some time, i.e. hot strike ignition, can be in the tens of kilovolts. There is no economic approach to address this issue. Some manufacturers use auxiliary igniters to address this situation; the majority of manufacturers recommend that the lamp be allowed to cool down for a specific period of time before ignition is reattempted.

## 6.0 Conclusions

This paper presented a general review of the operating principles of a high intensity discharge lamp system, with a focus on electronic ballasts that are used to power HID lamps for illumination applications. HID lamps operate at high pressure; this has implications on lamp performance and operating characteristics: The lamp enclosure should be designed for high temperature, the hot strike ignition voltage is large in comparison to the ignition voltages encountered in low pressure lamps, and acoustic resonances that can cause unstable lamp operation or enclosure rupture must be avoided. The square wave electronic ballast is considered the most economical and safest approach to powering a HID lamp.

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**(a) Parallel igniter**



**(b) Impulser igniter**



**(c) Superimposed pulse igniter**



**(d) Circuit of the superimposed pulse ignitor**

**Figure 10:  Implementation strategies for igniters:  All figures adapted from [7]**

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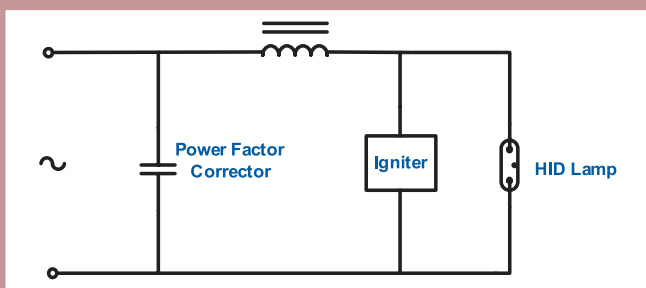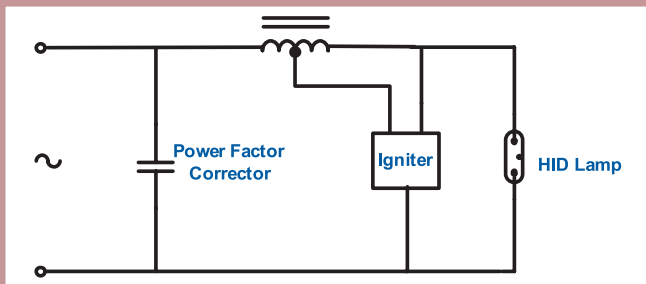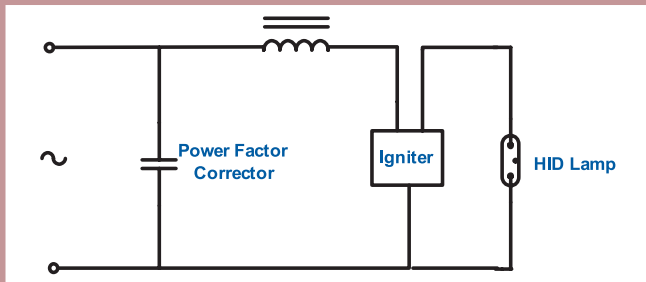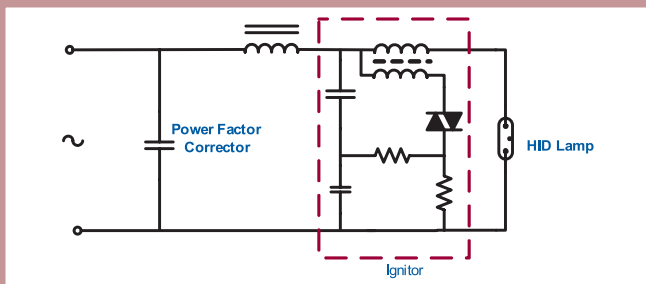
# Designing a Truly Integrated (Onsite and Online) Conference: Concept, Processes, Solutions

## 1.0 Introduction

**IEEE** is the single biggest organizer of conferences in the world, sponsoring more than 900 conferences annually. These events offer IEEE members and engineering community at large a great opportunity for professional communication and publishing their research results in the IEEE Xplore database—the world's highest quality collection of technical literature.

IEEE conferences occur in a variety of formats. A conference could be very large (with several thousand participants) or rather small (with under a hundred attendees). In this paper, we focus on a conference model, which is arguably the most common one—single location, several concurrent tracks/symposia, several hundred international attendees.

Internet and various web applications are used in virtually all domains of human activities. Preparation and delivery of conferences is one of the examples, where internet is widely used for dissemination of the information about a forthcoming event (through email and websites), collecting paper submissions, registering attendees, adding value to both organization and participation, and finally, storing conference papers in the online databases.

Using internet for various types of collaboration has become a mainstream in the industry and academia. Almost any email from a product or service vendor would include an invitation to attend a webinar, and most of us participate in the corporate online meetings on a regular basis.

It is obvious that similar types of the web conferencing technologies could be used in the delivery of the IEEE conferences. It is just a matter of time when these technologies will be mature enough to meet all the business needs of the conference organizers, and organizing committees will become fully aware of potential benefits and develop skills to incorporate web conferencing technologies in standard conference procedures.

The purpose of this paper is to draw attention of the conference organizers to the opportunities of the web conferencing, and share the knowledge and experience which have been accumulated during the preparation and delivery of the IEEE Toronto International Conference - Science and Technology for Humanity (TIC-STH) 2009 [1].

This publication is a concise version of the article. For the details see [15].

## 2.0 Truly Integrated Conference Concept

The use of the web conferencing technologies has been envisioned as a differentiating feature in the delivery of the IEEE TIC-STH 2009 since its inception. The objective of the conference (as it was announced in September 2008) was to deploy the following model: A multi-point worldwide-distributed network of conference authors/participants will enhance the standard (centralized) IEEE conference model, which requires attendance of the participants in person at the main conference location. The participants will be given a choice of delivering conference papers, tutorials, etc. either at the central conference site (hotel) or from their home/office computers wherever they are, eliminating the need of costly and time-consuming travel. This model will require seamless integration of the onsite and online conference systems, including data/presentation, video, audio, feedback, etc. We call this model a "Truly Integrated Conference" (TIC).

Please note that the abbreviation "TIC" also stands for "Toronto International Conference", but in this meaning it is used only as part of a complex abbreviation "IEEE TIC-STH 2009".

**The main features of the TIC are:**

➤ Use of technology allows onsite and online attendees to have similar opportunities to participate in a conference, have access to information and collaboration.

➤ Online attendees can deliver their papers live on the internet, as well as watch/listen to the broadcast from the conference site.

➤ Use of the web conferencing solution which includes web conferen-

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### *Abstract*

Web conferencing tools have entered the mainstream of business applications. Using web conferencing for IEEE conferences has a good potential of adding value to both organization and participation. Authors propose a concept of Truly Integrated Conference (TIC) according to which a multi-point worldwide-distributed network of conference online authors/participants will enhance the standard (centralized) IEEE conference model, which requires attendance of the participants in person at the main conference location. The concept entails seamless integration of the onsite and online conference systems, including data/presentation, video, audio channels. Benefits and challenges of the TIC concept are analyzed. Requirements to the web conferencing system capable of supporting the TIC conference are presented and reviewed against commercial web conferencing tools. Case study of the IEEE Toronto International Conference - Science and Technology for Humanity, which was the first realization of TIC, is presented which analyzes various aspects (organizational, technological, and financial) of the integrated conference.

### *Sommaire*

Les outils de conférences web font maintenant partie du quotidien des applications d'affaires. Les utiliser pour des conférences IEEE apportera sans doute des bénéfices aux organisations et aux participants. Les auteurs proposent un concept de Conférence réellement intégrée (CRI) selon laquelle un réseau mondial multipoints distribué de conférences en ligne auteurs/participants améliorera le modèle standard (centralisé) des conférences IEEE, qui exige la présence des participants au lieu principal de la conférence. Ce concept implique l'intégration uniforme des systèmes de conférences sur le site et en ligne, incluant les données/présentations, vidéo, canaux audio. Les bénéfices et défis du concept de CRI sont analysés. Les exigences relatives aux systèmes de conférences web capables de supporter une CRI sont présentées et comparées à ce que fournissent les outils commerciaux. Une étude de cas est présentée sur la Conférence internationale de Toronto - Science et technologie pour l'humanité, qui a été la première réalisation de CRI. Divers aspects (organisationnels, technologiques, et financiers) de la conférence intégrée sont analysés.

cing application integrated with video and audio technology means at the conference site.

➤ Web conferencing solution provides all of the following channels to facilitate collaboration and make communication "natural": data/presentation, video, audio, chat.

➤ The whole conference (not selected parts or tracks) is equally available to onsite and online attendees.

A literature review did not reveal any conferences which would utilize a concept similar to the TIC. Some conferences experimented with web casting of selected sessions (e.g. 2008 IEEE Geoscience and Remote Sensing Symposium [3]). Others completely moved to the online model (e.g. International Joint Conferences on Computer, Information, and Systems Sciences, and Engineering [4]).

Our search has shown that IEEE TIC-STH 2009 was the first IEEE conference delivered according to the TIC concept.

## 3.0 TIC Concept Benefits

TIC benefits are multiple and largely quantifiable.

### 3.1 For Participants

TIC allows participants to avoid travel to the conference site. An average direct savings per person per conference could be up to one thousand dollars. Also, avoiding travel (especially, international) will "create" a couple of additional productive days for a researcher. An important benefit is increased flexibility, e.g. should the working plans change and preclude travel, an attendee who initially was going to participate onsite can easily re-register to online participation.

The authors would like to emphasize that they are not promoting online conferences as a replacement for traditional onsite events. Nothing could be more stimulating for a researcher than an in-person interaction and exchange of ideas. A significant intangible value of the TIC concept is that it offers participants a freedom of choice—which events to visit in person and in which to participate online.

### 3.2 For Organizers

Having a certain percentage of participants online allows organizers to reduce conference food expenses, which could constitute a significant part (up to 50%) of the registration fee. This statement is based on the assumption that onsite and online attendees pay the same fees. Also, organizers have a good potential to attract many additional attendees without papers who will be only watching the conference online.

### 3.3 Environmental

Avoiding travel will have a certain environmental impact. It is easy to estimate that if 30% of the IEEE conference attendees will select the online option, it will result in a significant reduction of $CO_2$ emissions.

## 4.0 TIC Concept Challenges

Using the TIC concept to organize a conference requires addressing many challenges.

### 4.1 Psychological

As any new endeavour, integrated conferences will have a certain number of enthusiastic supporters. However, there will be even more people either neutral or reluctant to embark onto unknown soil. Some of them just do not want to take the risks (which certainly exist). Others see TIC as more of an online conference (which is not true), and are concerned that wide spread of this practice would become a roadblock for them to get funding for travel, and limit their opportunities for face-to-face communication with colleagues.

### 4.2 Technological

Selecting an appropriate web conferencing tool that meets the conference requirements is a serious challenge. Incorporating this tool into an onsite audio/video environment could be an even more complicated task.

### 4.3 Organizational

Documented procedures for web conferencing according to the TIC concept do not exist. It is not only that the technology means must be integrated. Creating a seamlessly integrated conference process requires collaborative efforts from web conferencing and all other conference committees. For example, such well-established processes as paper scheduling need to be performed taking into account local time of the online attendee to avoid inconveniences such as delivering a paper at 4 AM. Operating web conferencing technology requires additional human resources, which need to be recruited and trained.

### 4.4 Financial

Despite the potential savings for the organizers, web conferencing is not free. TIC implementation requires due diligence in assessing acquisition of services. At a first glance, hourly rates for web conferencing look reasonably low. However, mere multiplication of these numbers by eight (number of the working hours per conference day) and then by a range of seven to ten (number of the conference parallel tracks/symposia), and then yet by two to three (number of conference days), could shock any treasurer.

### 4.5 Legal

IEEE has rigorous and clear policies regarding copyright of conference papers. Paper presentations (PowerPoint slides) are not subject to the same scrutiny—they "exist" for several minutes during the conference and are available to a limited number of attendees in the conference room. Web conferencing actually turns verbal presentations into "documented content" through data, audio, video channels. This content could be delivered to hundreds and thousands of people around the world, and potentially could be recorded/stored both at the conference site and by any attendee. Lack of regulation of this issue should be a matter of concern for both organizers and presenters.

All challenges need to be taken into account and addressed by the organizing committee through the best practices of project risk management. Any improper decision may be harmful not only for the web conferencing part, but also for the conference as a whole. Some experiences and recommendations are provided in the IEEE TIC-STH case study below.

## 5.0 TIC Requirements to the Web Conferencing Solution

Selecting a web conferencing application and building a TIC solution for a conference is a complex task. To streamline and facilitate this process we developed a set of requirements presented in [15]. These requirements address the business needs of both the conference site and equipment of the online attendees.

Some requirements need to be highlighted.

Most important is to identify conference business scenarios that are to be supported by the web conferencing application. Our analysis has shown three types of business scenarios that could be found at most conferences:

➤ Scenario 1. Keynote/Tutorial/Training Presentation. Training scenario refers to the pre-conference educational events aimed at providing organizing committee, symposia TPC and conference technology assisting personnel with knowledge and skills necessary to support web conferencing.

➤ Scenario 2. Symposium Session (See Figure 1). Up to Twenty Five (25) symposia sessions hold simultaneously and independently.

➤ Scenario 3. Conference Discussion Panel (Round Table Session) or Committee Meeting.

The web conferencing tool should provide an environment with seamlessly integrated Data/Presentation, Video and Audio channels of communication for the collaboration of the conference participants onsite and online. Although most of the vendors provide tools which support all three channels, some either do not have a video channel, or do not recommend activating it in order to save the bandwidth and accommodate higher numbers of online participants.

Ideally, the web conferencing tool should be a truly web-based application, which will not require any other software installed on the computers of the online participants (exception could be made for a commonly used software like Flash). This requirement is driven by the intention to make participation more convenient, avoid possible problems, and accommodate restrictions faced by corporate users in the installation of additional software. The problem with this requirement is that in the "share the screen" mode, which is supported by many tools, installation of additional software/patches is mandatory (although that may not be acknowledged upfront by the vendor). "Share the screen" mode could be very useful, e.g. it could be used for demonstrating any online applications during presentation of papers. Organizers must choose if they want to limit possible formats of presentations to PowerPoint slides, or to accept risks of allowing screen sharing. That is one of the examples of how choice of web conferencing tools affects a conference as a whole (as the onsite participants will also be bound by the decision).

Each conference at the early stages of preparations has to review the suggested requirements based on its own needs, and develop a set of individual requirements to the web conferencing system.

## 6.0 Web Conferencing Applications

According to Wikipedia, web conferencing—also referred to as an e-conference, on-line meeting—is used to conduct live meetings, training, or presentations via the Internet. In a web conference, each online participant sits at his or her own computer and is connected to other participants via the internet. This can be either a downloaded application on each of the attendees' computers, or a web-based application where the
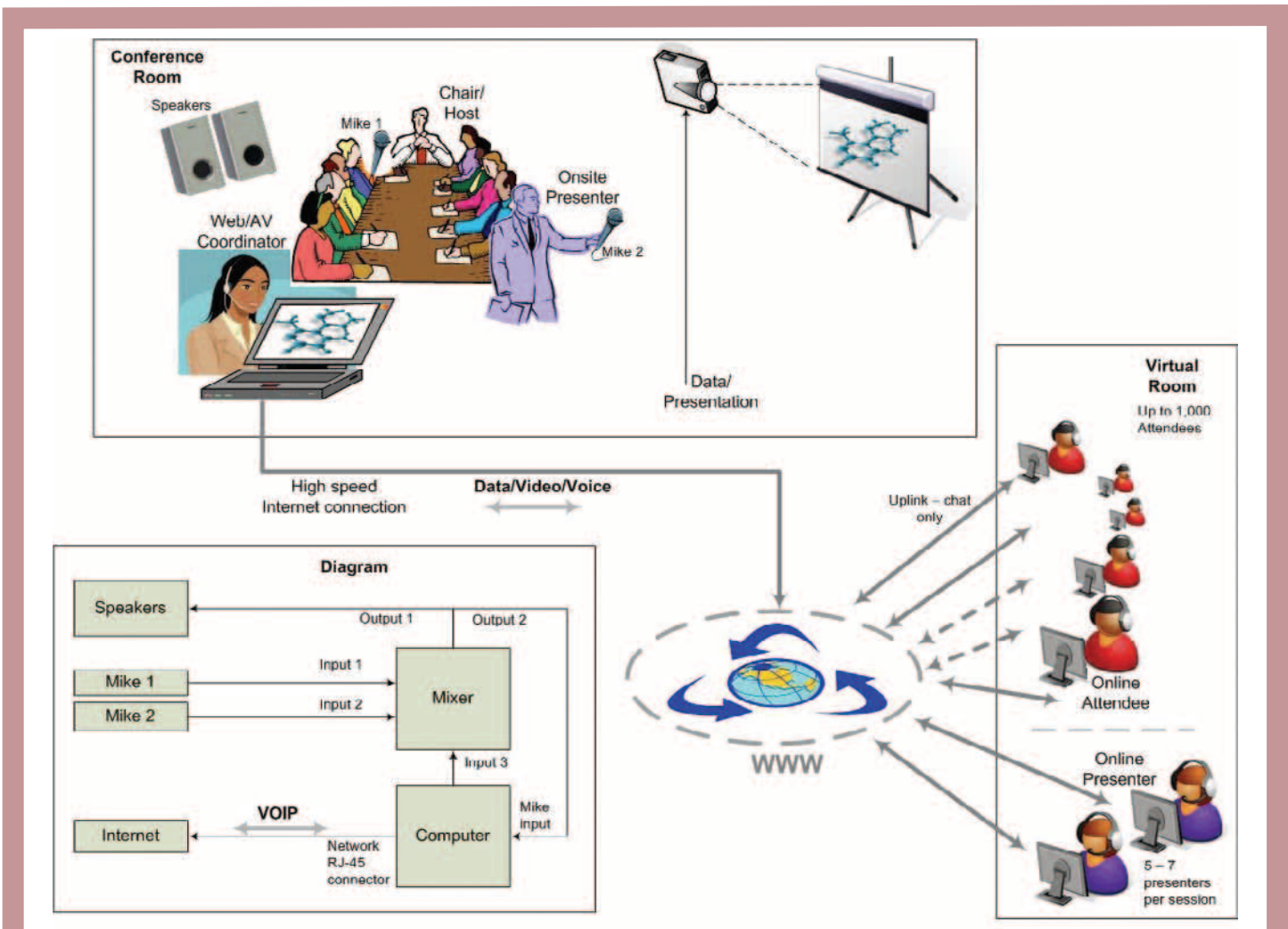
**Figure 1: Scenario 2**

attendees access the meeting by clicking on a link distributed by e-mail (meeting invitation) to enter the conference [11].

A webinar is a term to describe a specific type of web conference. It is typically one-way, from the speaker to the audience with limited audience interaction, such as in a webcast [11].

Considering the target of the web conference, we use the term "web conferencing" as the most appropriate to describe specifically the live or real-time connection of computers to allow a meeting to be held through the exchange of data, video and audio information.

Software for web conferencing has become increasingly popular in the last few years. In the summer of 1994, there were only two products. Both of them were rather primitive freeware packages. Now, there are well over 60 commercial and freeware products, many of them quite sophisticated, which support conferencing on the web in different kind of forms [14].

For the "application service" offered over the Internet without the need for installation of a server, vendor-independent testing has been conducted with the results reported in [13]; a comparison of the top five is found in [15]. However, when we looked for an appropriate web conferencing solution for IEEE TIC-STH 2009, we could not simply select one of the top ranking solutions. To make a choice, we had to consider operating system support, compatibility with other environments, administrative capabilities, browser support, customizability, and certainly, price.

During preparations of the IEEE TIC-STH 2009, the web conferencing committee reviewed many commercial tools against the conference requirements and conducted trials of several applications including WebEx, GoToWebinar, Adobe Connect, iVocalize, and Instant Presenter.* One of the observations was that there are two types of solutions supporting two models:

➡ Webinar model—central broadcasting to hundreds and thousands of users, e.g. GoToWebinar

➡ Corporate meeting model (multi-point participants), but the number of participants is limited to 15 - 20, e.g. WebEx.

Both GoToWebinar and WebEx tools were very easy to set up, and no problems occurred during the trials. However, GoToWebinar was not selected for two reasons. First, it does not have video. Second, it requires installation of a software patch, which is not allowed in some corporate environments. WebEx was not selected because the cost projections (for the scenarios with several hundred participants) turned out to be prohibitive for the conference budget.

An interesting solution of the combined use of the GoToWebinar and WebEx has been proposed and tested, overcoming the main problems of the individual tools mentioned above. To realize the solution, several (up to 15 - 20) participants make connection using WebEx, and then one of these participants turns on GoToWebinar in a screen sharing mode and starts broadcast of his screen (with WebEx application running with slides and video) to hundreds of online attendees. Trials confirmed that the WebEx video channel was broadcast by GoToWebinar without a problem. So, this solution enriches GoToWebinar with a video channel and at the same time allows WebEx to be received by hundreds of participants at a low cost. This solution could be helpful to deliver web conferencing according to scenario 3.

## 6.1 Audio channel

Most vendors provide a choice of voice over internet protocol (VOIP) or teleconferencing. It is revealing that usually the use of a phone line and a conference bridge is the recommended option, primarily for the sound quality reasons. The use of the phone to support a multi-hour conference with participants around the globe will most likely become unfeasible for budgetary reasons as a phone channel is not included in the price of the
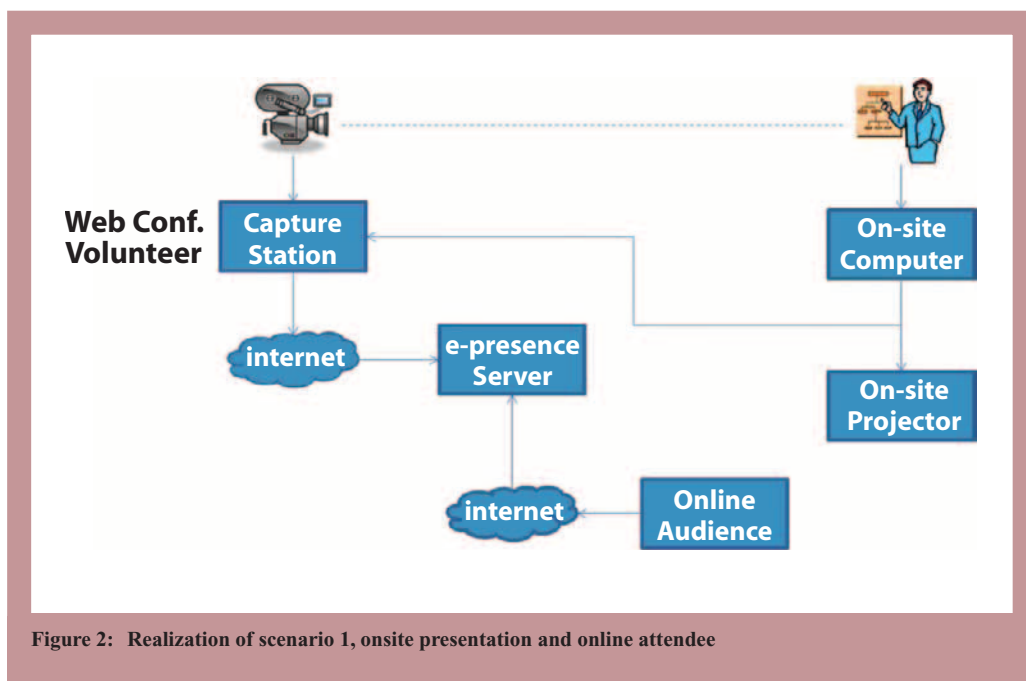
**Figure 2: Realization of scenario 1, onsite presentation and online attendee**

conferencing system. Each web conferencing volunteer received 10 hours of training and had to pass the exam to be able to contribute effectively to IEEE TIC-STH in web conferencing. This greatly helped run the online sessions more smoothly during the conference. Online users (attendees/presenters) needed to register beforehand to be able to attend/present. The accessibility level of all the online sessions was restricted to our registered users who had paid fully for the registration fee of IEEE TIC-STH 2009.

Scenario 1 was utilized by ePresence capture stations integrated with the presentation system in each presentation room as is shown in Figure 2.

To assist the online attendees, an instruction manual was produced and uploaded on YouTube [5]. This video manual describes all the required steps for the online attendee to be able to follow a presentation online.

All the concurrent presentations were broadcast online for our online attendees and also for our onsite attendees who wished to follow other concurrent presentations online while attending an onsite presentation. This allows switching between presentations by a click and attending the presentation that fits best within the interest of the attendee. Online attendees, similar to the onsite attendees, could ask questions using chat functionality.

The volunteers in the presentation rooms were advised to screen the online presentation. The coordination of the presentations with online presenter was done by means of chatting in the ePresence platform and backed up by a phone connection.

Keeping the conference completely broadcast online takes a lot of effort in troubleshooting and management. To make sure that the troubleshooting process would be handled as quickly as possible a separate group was hired. The common observed problems before/during the conference were as follows:

➧ There is a lot of hardware involved to capture/broadcast all the presentations and there is a high chance that camera, microphone, computer, projector and capture station might not work properly.

➧ The high speed connection with the web conferencing server needs to be monitored and maintained continuously.

➧ The online presenters need to be connected to a reliable high-speed connection.

➧ The presentations should be scheduled considering the fact that the online presenters have to present their work according to their local time.

In IEEE TIC-STH 2009, there were altogether 28 papers that were presented remotely out of almost 200 conference papers. The rest of the papers were presented onsite. All the papers were presented either onsite or online and there was no paper which was not presented due to the fact that the authors could not be present at the location of the conference. The web conferencing website was visited 1300 times following the presentations. Another possible benefit of the web conferencing-enabled conference is that not only all the presentations can be broadcast but also all the presentations can be recorded for later publication. The recorded presentations can be even bundled with the paper text and made accessible on IEEE Xplore website. The possibility of watching a presentation of the paper makes it easier for the reader to understand the paper when accessed later on the database. These benefits are supported by the existing technology, however certain legal and organizational issues need to be resolved first.

Although the web conferencing tool is the backbone of the TIC concept, there are other applications that can help organizers, e.g. Google Analytics and FilesDirect [15]

A post-conference attendee survey showed good customer experience of the online attendees. Although the conference was not immune to some roughnesses, the overall level of satisfaction of the online audience was even higher than that of the onsite participants.

web conferencing services. Another solution — streaming video and audio — provides an excellent quality of the audio channel. ON24 [8] is an example. However, prices for the streaming video and audio are usually very high.

## 6.2 Video Channel

This usually worked well for all products. It was noted that lighting of the presenter sitting in front of the camera is as important as the quality of the camera.

## 6.3 Result of Web Conferencing Evaluation

The conclusion was made that none of the commercially available web conferencing solutions fully satisfies the TIC concept requirements. Organizers have to make trade-offs between functionality, quality and costs based on the individual conference requirements.

Based on the above considerations and IEEE TIC-STH 2009 conference requirements, ePresence [9] was selected as a web conferencing system. ePresence is an Open Source web conferencing and webcasting system that delivers live or on-demand rich media over the internet. Developed by the University of Toronto, ePresence is a complete solution for streaming, capturing, and publishing rich media presentations. Considering ease of technical support, price, availability of ePresence Capture Stations offered by our conference host, Ryerson University, ePresence was eventually selected as a foundation of the TIC solution. In the next section, more details of the TIC implementation are presented as a case study analysis.

## 7.0 Case Study: IEEE TIC-STH 2009

IEEE TIC-STH 2009 was organized and hosted by the IEEE Toronto Section [2]. Ryerson University was used as a venue. The conference was focused on advanced interdisciplinary problems across a broad spectrum of the IEEE fields of interest. The scope was not limited to the traditional IEEE areas - electrical, computing, and engineering. There were very strong papers in education, social implications of technology and sustainable development of the society.

The conference attracted 360 papers out of which 186 papers were accepted after rigorous peer-review process (~50% acceptance rate). Authors represented 29 countries.

IEEE TIC-STH 2009 turned out to be a huge success story from all perspectives: technical, organizational, financial and customer satisfaction. Realization of the TIC concept was one of the drivers for this success. IEEE TIC-STH 2009 was the first truly integrated conference that realized scenarios 1 and 2 (described in the Requirements Section) for all the scheduled presentations. The facilitation of the online platform was done by ePresence conference services. There were, at most, eight concurrent (onsite/online) presentations to be handled at the same time. For this purpose, 16 volunteers were trained to work with the conference web

## 8.0 Conclusions and Recommendations

1. The concept of the Truly Integrated (onsite and online) Conference (TIC) has been suggested and discussed. A conference delivered according to the TIC concept presents significant benefits to both conference organizers and participants. Certain environmental impacts also should be assessed and considered.

2. The authors are confident that conferences of this type will soon become common for the IEEE and other organizations.

3. Business and technical requirements satisfying the TIC concept, and its incorporation into an integrated solution, have been developed and tested.

4. Analysis of the commercially available web conferencing solutions has shown that none of them fully satisfies the TIC concept require-ments. Conference organizers have to prioritize requirements based on the specific needs of the conference and, most likely, give up on less important ones.

5. Our search shows that IEEE Toronto International Conference— Science and Technology for Humanity (TIC-STH) 2009, organized by the IEEE Toronto Section, was the first IEEE conference (and maybe first ever conference) delivered according to the TIC concept.

6. IEEE TIC-STH 2009 successfully used ePresence web conferencing application.

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### About the Authors

**Alexei Botchkarev** is an information and knowledge management professional, consultant and researcher (www.gsrc.ca). He has over 30 years of experience in project management, systems analysis, modelling and simulation, business processes analysis, information systems solutions, requirements analysis and scientific research. He holds a Ph.D. from the aerospace R&D Institute (1985) and is currently a Senior Information Management Advisor at the Knowledge Management Branch, Ministry of Health and Long-Term Care, Ontario, Canada. In the course of his career, Dr. Botchkarev has worked as an employee or consultant in multiple industries (aerospace, information technologies, advanced materials, healthcare, education and training) in Canada, U.S., Europe, and Asia. He is past Chair of the IEEE Toronto Section and was founding member of the IEEE TIC-STH 2009 Organizing Committee.

**Lian Zhao** received the Ph.D. degree in electrical and computer engineering from the University of Waterloo, Canada, in 2002. Before she joined Ryerson University in 2003, she worked as a postdoctoral fellow with the Center for Wireless Communications, University of Waterloo. She is an Associate Professor at the Department of Electrical and Computer Engineering, Ryerson University, Toronto, Canada. She is a cofounder of the Optic Fiber Sensing Wireless Network Laboratory in 2004. Her research interests are in the areas of wireless communications, radio resource management, power control, as well as design and applications of the energy efficient wireless sensor networks. She is an IEEE Senior Member and a Registered Professional Engineer in the province of Ontario, Canada. Lian Zhao was Chair of the Web Conferencing Committee of the IEEE TIC-STH 2009.

**Hamed Rasouli** is a Ph.D. candidate in Radio Resource Management and Radio Access and Networking (RRM+RAN) research group at the Department of Electrical and Computer Engineering, Ryerson University, Toronto. He received his B.Sc. with Distinction in Electrical Engineering - Telecommunications from the University of Tehran, Iran in 2003 and completed his M.Sc. at Iran University of Science and Technology afterwards. His research interests include radio resource allocation and management in cooperative and cognitive radio wireless communication systems. Hamed Rasouli was Vice Chair of the Web Conferencing Committee of the IEEE TIC-STH 2009.

# Multi-User Interactive Surface Using Computer Vision

*By    Issa Al-Fanek, Sam Sadighi, Eric Louis*
*Concordia University*

*Supervisor:  Dr. Mohammad Reza Soleymani*

## 1.0 Introduction

**M**ulti-Touch technologies are exciting topics in today's technology markets. Their popularity has grown exponentially since the release of the iPhone by Apple two and a half years ago, and Microsoft Surface last year. Multi-Touch technologies allow for multi-finger input and interaction with a device, hence, they open new fields for research and innovation in natural and intuitive user interfaces.

Although the capacitive multi-touch display that the iPhone uses works great for this small device, the cost associated with the production of displays with large dimensions is high. To solve this problem, our approach is to utilize a camera beneath a semi-transparent surface or display coupled with computer vision, and digital signal processing algorithms to process, then detect and interpret finger touches, and gestures captured from the camera in real time.

The design and implementation of our project uses concepts and techniques that include the use of several Digital Signal Processing (DSP) as well as computer vision algorithms to read and interpret finger presses, touches, and gestures to provide new and unique approach to computing and control. In addition, our team managed to develop a multi-touch table that integrated our conceptual ideas into a physical and tangible device that humans can see, touch, and easily interact with. Furthermore, we developed several software demos and applications to demonstrate some of the capabilities of the multi-touch surface technology using computer vision. Nevertheless, we need to keep in mind that using our technology, engineers and software developers can further expand the capabilities of the multi-touch surface by creating new applications through a simple to use yet powerful Application Programming Interface (API).

During the development of the multi-touch surface, we categorized the overall project into two main components: hardware and software. The idea was to develop these two components individually and simultaneously in a parallel fashion and then integrate them together when both components had been completed and tested individually. The main idea of the physical concept was to use a phenomenon known as Total Internal Reflection (TIR) from the fields of optics and electromagnetics to entrap infrared light inside an acrylic glass. Using the concept of TIR, the light would be entrapped inside the acrylic glass until it is frustrated by the user's touch causing the light rays to be sent down onto the camera placed beneath the surface. Consequently, the camera is able to detect the location where the user has touched the surface by detecting the location of the bright spot caused by the light rays being sent down. In terms of output, images are displayed in real time using a projector that is also placed beneath the surface. To avoid electromagnetic interference between the camera and the projector, an IR camera was used to filter out the visible light of the projector. All of the main interactions between the user and the multi-touch surface are figured out through computer vision and smart detection algorithms. In other words, the camera captures the bright spots on the touch surface, then the software

### Abstract

The IEEE Canada - TELUS Innovation Award has been presented since 2005 to recognize the best undergraduate projects in Canadian institutions. This significant event is generously supported by TELUS. A team from Concordia University won 1st place in 2009 for their project "Multi-User Interactive Surface Using Computer Vision", a complex algorithm developed to detect and track multiple finger-touches moving on a semi-transparent surface using a camera installed beneath it. It has many potential applications: information kiosk, interactive touch screen coffee table – with integrated TV remote!

### Sommaire

Le Prix d'innovation IEEE Canada – TELUS a été présenté depuis 2005 pour reconnaître les meilleurs projets de premier cycle dans les institutions canadiennes. Cet événement significatif est supporté généreusement par TELUS. Une équipe de l'Université Concordia a remporté le 1er prix en 2009 pour leur projet « Multi-User Interactive Surface Using Computer Vision », un algorithme complexe développé pour détecter et suivre de multiples commandes tactiles sur une surface transparente en utilisant une caméra installée dessous. Il a plusieurs applications potentielles : kiosque d'information, table de salon interactive à écran tactile – avec télécommande TV intégrée!

handles detection and interpretation of gestures and touches, and translates them to actual actions on the surface itself.

It is worth mentioning that our unique and intuitive approach allows for different users to collaboratively and simultaneously interact with computers. Multiple individuals can interact with the device at the same time. Our approach eliminates the need to use traditional and outdated User Interface (UI) elements that originated in the early 80s, and opens a new world for natural user interfaces that allow the users to touch and move objects on the screen as they would do in real life. Furthermore, the physical display or screen can be easily expanded to larger displays without adding much to the cost since the act of expansion only requires the addition of cameras and processing power. Finally, from a practical point of view, the display can be mounted vertically on a wall, or mounted horizontally on a table as we have done in our project without changing the actual algorithms that have been developed. The combination of all these properties implies that the multi-touch technology can be attractive for both custom-made as well as mass-produced markets.
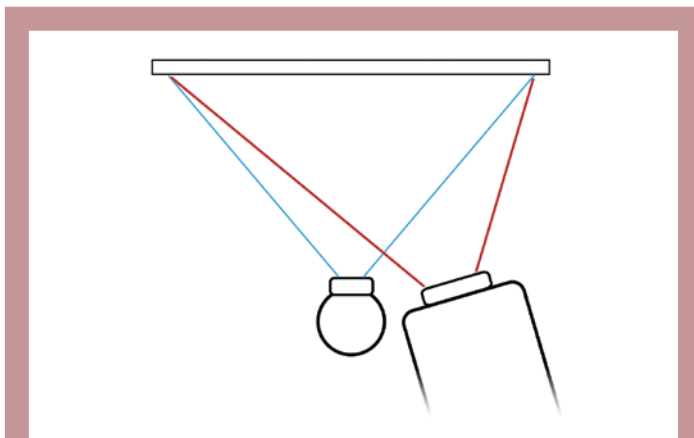


Fig. 1:   The idea behind accomplishing multi-touch using computer vision



Fig. 2: A multi-player game demo on the surface!

## 2.0 Multi-Touch and Multi-User Features

One of the unique characteristics of our product is that it allows for seamless multi-touch interaction between the user and the multi-touch surface. Therefore, the user can use both hands to interact naturally with the device. So far, many similar products allow for only one finger or maximum two to four finger interaction between the user and the device. Nevertheless, our product is extensible to as many fingers as desired.

Another implication of multi-touch is the ability for multiple users to interact with the surface at the same time. This simultaneous interaction allows friends or family members to browse family albums, play games, or play different virtual musical instruments together. That is simply not possible with today's UI paradigms that depend on mice and keyboards for input. Depending on the imagination of the users and their interests, the multi-user aspect of our product opens the door to limitless possibilities of applications and interactions between humans and machines.

## 3.0 Extending the Project in the Future

In this project, we have created a platform that can be used as a starting point for others to build upon and enhance. We have thought of some ways of extending our technology and taking it to the next level. One such approach is the expansion of the size of the display. Larger touch surface designs can be easily achieved by adding more projectors, and more cameras.

## 4.0 Market Research, Usability, and Prospects

Based on our market research, we have discovered that the majority of people would like to enjoy a natural way of interacting with their machines and devices. In the past few decades, we have seen a tremendous amount of improvements and accomplishments in the world of technologies. At the same time, a huge gap has developed between different generations—the new generation uses computers to perform most of their daily activities whereas the older generations are mainly cutoff from the new age technologies. Nevertheless, this product proposes a new approach, a better approach. Through the use of natural user interface and multi-touch surface technologies, the older generations will find it easier to interact with new technologies and hence will begin to use them more. They will not be intimated by the use of keyboard and mouse; they will simply use their fingers to move things, which is natural. Even children are comfortable with moving their fingers and touching things to learn about those objects. Our team truly believes—based on research, personal understanding and experience—that our society needs to integrate the elders and youth through various activities that benefit both. Based on research and positive feedback we have received along with the consideration of a vast range of individuals who can truly benefit from this product, our analysis indicates that this product will be a great success and a revolutionary step towards the future of modern technologies.



**Fig. 3: The smart multi-touch surface Prototype**

There are various groups and institutions that would be interested in obtaining one or more of these revolutionary products for their environment. The range of targeted audience varies from households to schools and universities to companies and corporations to airports and shopping malls to cruises and hospitals to restaurants and others. There is really no limit to the extent to which this product can apply to. In other words, this is the new way that human beings will interact with digital contents.

In schools for instance, children starting from young age can use the multi-touch surface to find their country on the map or use Google map to surf the world by turning it around with their finger touches. They can travel to space and learn about planets by moving them and writing their respective names with their hands or infrared pen in the bottom of each planet or star. They can do art work or play music on these machines and then use various software applications to modify the music and add other features and instruments to their own music.

Hospitals can make use of these machines for the doctors and nurses. Engineering team projects can develop their own applications and use those applications with different engineers working with the multi-touch surface at the same time. A team of architects, for instance, can develop their designs, simultaneously. This kind of approach can save time, cut costs, and in case of a disagreement, the team can decide then and there together since everything is occurring simultaneously.

Households can make use of this product in their living rooms. Individuals can control their TV, light illumination, as well as temperature controls of their house from one place, their couch. Moreover, if they have friends or family over, they can view pictures of their last vacation on the multi touch display and create an album of their pictures. And depending on their mood, they can browse their favorite song and play it in the background.

In universities, class rooms can be interactive and professors can use the multi-touch surface depending on their application. Smart whiteboards, for instance, can remember their previous settings, so that the professor would not have to redraw the model, picture, or circuit, again. The professor can just refer back to the desired setting and modify or demonstrate it as desired. This can save time and effort for both the professors and the students.

Lastly, we can mention that one of the preconditions of our modern society is the use of computers and machines on regular basis. Many of state-of-the-art technologies are targeting alternative approaches to human machine interaction that would improve the overall system. The multi-touch surface technology that we have developed is essentially a new way of interaction between humans and machines. The users no longer need to use a mouse or a keyboard. We now have natural user interface. The users can now write and paint, play musical instruments, view and move pictures and objects, all with a simple touch of their fingers.

For more information, or to see a video demo of the smart surface in action, visit: http://issafanek.com/Projects/MultiTouch/theStory.html

### About the Authors

**Issa Al-Fanek** received his Electrical Engineering degree from Concordia University in December 2009. Currently, he is a first year masters student at Concordia University. His research interests include collaborative coding techniques, computer vision, and natural user interfaces. During his studies, Issa has received numerous awards for his academic achievements. In summer 2009, Issa interned in a leading IT company in the middle east (Middle East Data Systems - MDS). To know more about Issa, please visit http://www.issafanek.com

**Sam Sadighi** completed his Electrical Engineering Degree from Concordia University in December 2009. He has proudly served as the marketing director of Concordia IEEE Student Branch for more than two years. During his studies at Concordia University, Sam Sadighi has been the recipient of various awards and scholarships from numerous institutions such as banks, utilities, telecommunication companies, federal government, and other institutions.

**Eric Louis** is nearing the completion of his Electrical Engineering Degree from Concordia University. During his undergraduate studies, Mr. Louis developed an interest in telecommunications, particularly the design of RF and microwave wireless systems. He has obtained awards and distinctions from his school and from a telecommunications company. He is a member of Concordia University's amateur radio club and is pursuing a certificate in amateur radio.

# Great Volunteers

I n issue 61, we introduced readers to the IEEE publication *A 25-Year History of IEEE Canada: Advancing Engineering Across Borders*. In this issue we reprint the pages highlighting some of the significant personal volunteer contributions.

Three Canadian members have been elected to the prestigious and demanding position of IEEE President. Three other volunteers were profiled for their contributions in the areas of IEEE membership database management, membership online self-renewal, and the establishment of the IEEE GOLD program. In future issues, we will bring you more news of members' contributions to the IEEE organization.

## Canadians and the IEEE Presidency

**No history of IEEE Canada would be complete** without mention of the members who have been elected to the prestigious position of IEEE President. At this writing, three Canadians have led IEEE in this capacity.

### Robert H. Tanner (1915-2002)

Robert Tanner joined the Institute of Radio Engineers (IRE) in England in 1938 after graduating from Imperial College (University of London) with a B.Sc. in Electrical Engineering, later receiving a M.Sc. in Acoustics. He became a Senior Member in 1948 and a Fellow in 1958. Mr. Tanner became Ottawa Section Chairman of Region 7 in 1965 and was Secretary Treasurer from 1963 to 1967. He was elected Regional Director in 1968, appointed Institute Secretary in 1970, elected Vice President in 1971 and President in 1972.

During his year of office, he set up the U.S. Activities Committee (now USAB) and steered the constitutional amendment on professional activities through the Board of Directors. Mr. Tanner was active on several Institute committees, including the chairmanship of a special three-year Long Range Planning Committee and service on the Foundation Board. Mr. Tanner has received two honors from Region 7: the A.G.L. McNaughton Gold Medal in 1974, IEEE Canada's highest award, and the IEEE Haradan Pratt Award in 1981 "for contributions toward professionalism and dedicated service to the Canadian Region, to IEEE and to the profession over many years."

### Wallace S. Read

Dr. Wallace Read of St. John's, Newfoundland, Canada, brought a worldview to the IEEE Standards process that forever changed the way the organization serves its constituents. As Vice President of IEEE Standards Activities from 1993 to 1994, he strengthened relations with the International Electrotechnical Commission (IEC), the International Telecommunications Union (ITU) and the International Organization for Standardization (ISO), thereby positioning the IEEE for a greater leadership role in international standards development. During this same period, Dr. Read played a key role in refining the IEEE Standards Activities' structure to better serve industry through the formation of the IEEE Standards Association (SA) and the IEEE Industry Standards and Technology Organization (IEEE-ISTO).

An IEEE Life Fellow, Dr. Read served as IEEE President in 1996 and was on the IEEE Board of Directors for a decade. His many honors include the IEEE Standards Association

## Notable Canadian IEEE Members

**IEEE is made up of thousands of dedicated, hardworking members** who are committed to supporting engineering and the engineering profession in Canada. A special thank you goes out to a few Canadian IEEE members who have been instrumental to changing IEEE in a significant and positive way.

### Brent Hughes

As the Publicity Chairman for the Vancouver Section, Mr. Hughes was instrumental in creating the first IEEE membership database (SAMIEEE). The database greatly improved how IEEE accessed member information, allowing us to reach out to members in a more productive and targeted manner. For his efforts, Mr. Hughes received the Distinguished Service Award for 1989-1990 from the Vancouver Section, a Special Recognition Award from the IEEE Regional Activities Board (presented at Sections Congress 1990 in Toronto, Canada) and a Third Millennium Medal in 2000.

### Gerald Karam

While serving as the IEEE RAB SAC Chair, Gerald Karam developed the first online registration system. Initially created for students, the early system evolved to make online application more efficient for all IEEE members. Dr. Karam has served as the IEEE-Canada Regional Student Representative, 1985-1986; Chair of the IEEE-Canada Student Activities Committee, 1988-1990; Chair of the Student Professional Awareness Activities (SPAA) Subcommittee of the Regional Activities Board's Student Activities Committee (RAB/SAC), 1992-1994; Vice Chair of RAB/SAC, 1995; and Chair of RAB SAC, 1996-1997. Dr. Karam is an IEEE Senior Member and received the IEEE Third Millennium Medal in 2000, as well as the 1998 Regional Activities Board Innovation Award.

### Dave Kemp

Dedicated to helping recent graduates find their way in the engineering profession, Dave Kemp served as the first IEEE GOLD Committee Chair. For this work, he was recognized with the 1997 Regional Activities Board (RAB) Leadership Award. Mr. Kemp served as President of IEEE Canada and Director, IEEE Region 7, 1998-1999 and as IEEE Secretary, 2000. He is a Senior Member of IEEE and a Fellow of the Engineering Institute of Canada. Mr. Kemp has also served on the boards of two Societies and is a member of the ICF.

International Award and the IEEE Power Engineering Society's Power Life Award. Dr. Read has also been a Member of the Order of Canada since 2003 and was the first recipient of the W.S. Read Service Medal in 2000.

### Raymond D. Findlay

Dr. Raymond Findlay earned his B.A.Sc., M.A.Sc. and Ph.D. degrees from the University of Toronto and began his teaching career at the University of New Brunswick (1967-1981) before joining McMaster University in 1981, where he is currently Emeritus Professor in the Department of Electrical and Computer Engineering. He holds four patents in electromagnetic fields and losses in electrical power devices.

Dr. Findlay has served on the IEEE Board of Directors, 1994-1997, 2001-2003; as President of IEEE Canada, 1995; IEEE Vice President, Regional Activities, 1996-1997; and as IEEE President in 2002. In addition to various regional positions, he has been active in several IEEE Societies and serves on the IEEE Canadian Foundation and the Council of the Engineering Institute of Canada, where he is currently the Chair of the History Committee.

A Fellow of IEEE and the Engineering Institute of Canada, Dr. Findlay's many awards include the IEEE Canada Merit Award, the IEEE Millennium Medal and the W.S. Read Service Award. He was also awarded the 2007 IEEE Canada A.G.L. McNaughton Medal in recognition of "outstanding contributions to the analysis and design of electrical machines, particularly to the theory and measurement of shaft currents in induction motors, and for leadership in the profession." ∎

## Lancement du site du Réseau global d'histoire de l'IEEE

En 2008 le Réseau global d'histoire (RGH) de l'IEEE a été lancé: http://ieeeghn.org/wiki . Il s'agit d'un nouveau portail à contenu libre développé par le Centre d'histoire du IEEE. Avec des contributions attendues de milliers, possiblement de dizaines de milliers de volontaires, l'IEEE s'attend à ce que le RGH devienne la principale archive publique pour la préservation et l'interprétation de l'histoire de l'innovation technologique.

Pour contribuer au RGH, les membres du IEEE peuvent accéder au site avec leur identification et mot de passe de compte web IEEE. D'autres contributeurs potentiels qui ne sont pas membres IEEE peuvent demander un accès via un lien distinct. Les contributeurs pourront créer de nouvelles fiches et ajouter aux fiches existantes avec des narrations écrites, photos, dessins, schémas, documents, et enregistrements vidéo ou audio.



## IEEE Milestone: The First External Cardiac Pacemaker

*"His invention saves millions of lives…"*

*By* Visda Vokhshoori, IEEE Toronto Section

The Banting and Best Institute is located half a block east of Toronto General Hospital on the north side of College Street, across from the MaRS building. Its humble looking facade does not reveal to its observer the numerous inventions that were spawned in its halls.

When I arrived for the plaque unveiling ceremony, a little before 2 PM on September 26, I could not help but imagine what would have been like to go back in time and be in the company of the great man, Dr. John Hopps. In his own words, "There was no intent to sit down and develop a pacemaker. As so often happens, one piece of research spins off into something else." [Hopps' interview with CBC Front Page Challenge, 1984] These were humble remarks for a man whose invention has saved and improved lives of millions of people.

Half a century later, the IEEE History Committee and Board of Directors recognize Hopps' Extra Cardiac Pacemaker as a significant achievement and award this invention the IEEE Milestone status. Pelle Westlind, IEEE Toronto Life Member Chair, Patrick Finnigan, IEEE Toronto Section Life Member Vice-Chair, Ferial El-Hawary, IEEE Canada President, and Donald Hopps, son of late Jack Hopps, animated the ceremony. And now the front wall of Best and Banting is adorned with the bronze plaque honoring this far-reaching engineering developement. Congratulations to the inventors, and to the volunteers who steered forward this recognition.



*L to R: Ferial El-Hawary, Pelle Westlind, Donald Hopps, Patrick Finnigan*



Bob Alden, a recipient of a History Committee Recognition, was honoured November 17, 2009 at the IEEE Foundation Board meeting in Piscataway, New Jersey. This new Recognition Program was approved a few days earlier by the IEEE History Committee. At left the Committee's 2009 Chair, Richard Gowan, makes the presentation.

The citation reads:

*"The IEEE History Committee recognizes the contributions to the history activities of IEEE made by Robert Alden, whose efforts have increased the recognition by the general public of technical achievements in IEEE's fields, and enhanced the appreciation of those achievements and their contributions to humanity.*

*Richard Gowan*
*Chair, 2009 History Committee"*

# IEEE Canadian Foundation Awards

*By David Whyte, V. P. Grants, IEEE Canadian Foundation*

## 1.0 2009 IEEE Canadian Foundation Awards

The IEEE Canadian Foundation (ICF) awarded just over $42,000 in 2009, as three IEEE McNaughton Learning Resource Centre Grants, seven IEEE Canadian Foundation Special Grants, five IEEE Canadian Foundation Scholarships, and five endowed awards.

## 1.1 McNaughton Centre Grants

IEEE McNaughton Learning Resource Centres enhance the learning experience of our engineering students. The IEEE Canadian Foundation provides grants to establish and upgrade Learning Resource Centres in 33 Canadian Universities and Colleges across Canada. Recipients must raise a minimum of 25% of the cost of their project from other sources. Upgrade grants allow students to refresh and enhance the resources within their Learning Resource Centres. In 2009, upgrade grants were awarded to student branches at:

* University of Calgary (Marc Beaudin - SB Chair) for (a) an additional soldering station to improve access, (b) devices to program microprocessors and enhance learning, and (c) materials to construct a robot for students to gain experience with multidisciplinary teams.



*UBC IEEE Students broaden their horizons at Stanford U.*

* University of Ottawa (Alex Ayala - McNaughton Centre Director) - for items to build a virtual server for router simulation and LAN/WAN simulation, new PC's to speed student projects, and a projector for presentations

* University of Saskatchewan (David Williams - SB Chair) - fume extractor for use during soldering, data logger and digital multi-meters for laboratory use, and development boards for design projects.

## 1.2 ICF Special Grants

IEEE Canadian Foundation Special Grants are awarded to groups (or occasionally individuals) with some kind of connection to IEEE in Canada under the following project areas:

* Using technology for humanitarian causes

* Student Branch activities that excite high school students about engineering or computer science

* Student Branch entries into national or international design competitions

* Student Branch activities that promote interaction with industry - including SPAC's

* Extraordinary initiatives outside these areas that contribute significantly to the mission of the IEEE Canadian Foundation.

In 2009, ICF Special Grants were awarded to:

* **University of Calgary (Marc Beaudin - SB Chair) Innovation for Humanity: the Design Challenge.** The objective is to inspire and challenge students to develop the skills and the motivation essential to their future contribution to society by engaging students in a hands-on, intensive design competition and making them think critically about the human and social issues concerning the implementation of technology.

* **Carleton University (Jieyi Rong - SB Chair) IEEE Connects 2009 - From Backpack to Briefcase.** IEEE Connects is a formal dinner event. Students and employers will have the opportunity to network with each other in a friendly environment along with professionals

and academics representing engineering. Successful engineering professionals will share their experiences to illustrate how students can prudently plan their career in the present day context and embark on their most desired professional career.

* **All Saints Catholic High School Robotics Team (Paul McDonough - Kanata),** a dedicated group of high school students ranging from Grades 9 through 12. Their objective is to provide students with hands-on experience in various disciplines such as engineering, programming, design and project management, as well as team building. They aim to enter the regional competition in Toronto and reach the world championship in Atlanta in April 2010.

* **UBC Thunderbots (Adrian Wong - ECE), a Robocup Small Sized League Student Team.** The objective is to create an environment for research and education in robotics for students, through a competitive robotics project utilizing a centralized intelligence system using global machine vision and wireless communication. The Thunderbots is an engineering student team based in the University of British Columbia. The team is entirely student run with over forty engineering and computer science students dedicated to creating a team of autonomous soccer playing robots for the Robocup Games and the annual International Robocup Competition.

* **Université de Sherbrooke (Denis Bellavance) Quebec Engineering Competition 2010.** The goal of this provincial competition is to give to engineering students an enriching academic experience that goes beyond school teaching. The Quebec Engineering Competition (QEC) is an event that brings together all engineering schools and faculties in Quebec. Every year, over 200 students who showed outstanding performance in their own school are asked to use all their skills, as much on the scientific knowledge as on the communication level. QEC represents a unique event to promote engineering in Quebec and student's work and creation in a forward-looking way.

* **University of British Columbia (Aryan Navabi - SB Chair) UBC IEEE Student Branch Silicon Valley Field Trip 2009.** The goal is to bring some 50 UBC engineering students to Silicon Valley to experience first-hand, different engineering environments. This twelve day field trip will include leading companies such as Cisco Systems, Google, Intel, Apple Inc., HP, IBM, Microsoft, and Boeing. While visiting these companies, students will get a chance to see upcoming technologies in the design phase.

* **IEEE Canada 2009 Student Branch Training Workshop.** This event is held annually for IEEE student branch chairs and counsellors.

## 1.3 ICF Scholarships

IEEE Canadian Foundation Scholarships are awarded to IEEE Student Branch volunteers nominated by their Student Branch Counsellor for showing exceptional leadership in the operation of the IEEE McNaughton Learning Resource Centre at their university or college. The nomination must be accompanied by a report from the nominee on their Centre activities over the past year. The nominees must be in their penultimate year of undergraduate studies.

The student receives a framed certificate at their local Section meeting and the cheque for the value of the scholarship is deposited in the student's university (or college) account to be applied to student fees in their final year. In 2009 the value was $3,500 for university students and $1,750 for college students (the difference reflecting the difference in

university and college fees). The 2009 scholarship recipients are:

* Prabhat Kumar - University of Victoria
* Hau Jun Liu—University of Toronto*
  *(joint award with Toronto Section)
* Jieyi Rong - Carleton University
* Susan Ryan - Memorial University of Newfoundland

### 1.4 Endowed Awards

These awards, in general, are endowed by directed gifts - a $20,000 gift will endow an award with an annual value of $1,000. The following awards were presented in 2009:

* **The IEEE Canada Power Quality Scholarship** recognizes Amir Motamedi of the University of Calgary, nominated for outstanding performance in both course work and research; as well as his commitment and his recognition that power quality analysis is a critical and demanding subject in a more advanced and sophisticated power grid. Endowed by the trustees of the Alberta Power Quality Conference.

* **The IEEE Canada Women in Engineering Prize** was awarded to April Khademi of the Toronto Section. She has been a role model to other young women by taking part in several outreach activities and has been a very active member of the community. Efficient, a great team player and problem solver, April is very active with IEEE and takes any opportunity to get involved. This prize was endowed by the donations of two individuals to the Judy Clift Fund.

* **The IEEE Canada Vehicular Technologies Travel Grant** will support Andrew Roberts of the University of Western Ontario to present his paper Adaptive Position Tracking of VTOL Unmanned Airborne Vehicles at the 48th IEEE Conference on Decision and Control (Shanghai). This grant recognizes a talented and hard working student who believes that attending this important conference will motivate him further in his research work, and promotes Canadian expertise to an international audience. This grant was endowed with funds from the proceeds of a Vehicular Technologies Conference donated to IEEE Canada and transferred to the foundation. The same endowment also supports the IEEE Canada Vehicular Technologies Research Grant, which could not be awarded in 2009, but will continue to be open for applications.

* **The ICF Quebec Science Fair Prizes.** There are two prizes annually, sponsored by the MCI fund (Montreal Conferences Inc.), awarded at the Expo-sciences in Quebec: One named after the late Shoaib A. Khan for a project in electricity or electronics, the other named after Eloi Ngandui for a project in computing. Both honourees are former very active and respected members of the IEEE Montreal and Saint Maurice Sections, respectively.

* **The IEEE Canada W.S. Read Outstanding Service Medal.** This award is sponsored by the IEEE Canadian Foundation and was first presented in May 2009 to Dave Kemp.

### 3.0 Future Endowed Awards

Two directed gifts have been received in 2009 by the IEEE Canadian Foundation and will result in annual payments to IEEE Canada commencing in May 2010. TELUS is the sponsor of the IEEE Canada Fessenden Medal (in Telecommunications) and the Canadian Heads of Electrical and Computer Engineering is the sponsor of the IEEE Canada Outstanding Engineering Educator Medal. We thank TELUS and CHECE for their generosity and support of the IEEE Canada awards program.

### 4.0 How You Can Support the Foundation

The IEEE Canadian Foundation needs your support to help us deliver our programs of Scholarships, Learning Resource Centres, and Special Grants that are financed from our General Fund. IEEE Life Members can contribute to the Life Members Fund.

Endowed Funds include the Judy Clift Fund (Women in Engineering Prize), the Montreal Conferences Inc. Fund, the TELUS Fund and the CHECE Fund. Directed donations can create similar Funds to establish and sustain annual scholarships, awards or prizes.

Our newest fund, the Technology for Humanity Fund was created in 2009 to support new and innovative projects within Canada that seek to apply technology for the benefit of humanity.

Donations over $1000 may be directed to a specific purpose that is consistent with the overall mission of the IEEE Canadian Foundation.

Donations may be made in any of three ways, please choose the one most convenient for you;

* By cheque made out to the "IEEE Canadian Foundation" and addressed to The Treasurer, IEEE Canadian Foundation, 456 Rogers Street, Peterborough, Ontario K9H 1W9. Tax receipts are issued by our treasurer.

* Online through our secure web site where you can donate to our General Fund, our Life Member Fund, or our Technology For Humanity Fund - you will receive your receipt for tax deduction by return email

* At the time of your annual IEEE membership renewal. Note that tax receipts are issued in the New Year after IEEE staff have transferred donation records to our treasurer.

Donors may donate anonymously or be recognized in our Honour Roll of Donors, first published in the IEEE Canadian Review, Number 61.

### 5.0 What's New for 2010

Effective 2010, the amount for the IEEE Canadian Foundation Scholarship increases to $5,000 for university students and $2,500 for college students. The number of scholarships is limited. This increase in value ensures that these scholarships continue to be a significant recognition of exceptional students.

The IEEE Canadian Foundation encourages submission of applications for Special Grants that support new and innovative projects within Canada that seek to apply technology for the benefit of humanity. As donations and sound investments grow our Humanitarian Fund, we will be able to support more initiatives in this area.

### 6.0 How to Learn More

To learn more about submitting applications or nominating someone or making donations, or reading more success stories, or to donate on-line, please visit http://ieeecanadianfoundation.org

--- *About the Author* ---

David Whyte (SMIEEE, P.Eng.) received his B.A.Sc. and subsequent business studies from the University of Toronto. He has worked in a variety of technical and management positions in the telecommunications industry. Currently he is Managing Principal at DAMAR Consulting. He has served the IEEE as Chair of the Communications Society Chapter and Section Chair in Toronto, and more recently on the IEEE Canadian Foundation Board of Directors, where he is Vice President Grants. He is also a past President of the Canadian Telecommunications Consultants Association. In 2009, he received the IEEE Canada M.B. Broughton Central Canada Merit Award for outstanding contributions to the IEEE Toronto Section and the IEEE Canadian Foundation over the past 25 years.

**IEEE Canadian Foundation**
Fondation Canadienne de l'IEEE

*N.Ed.:* **The Foundation's relationship with IEEE**

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# Canada and the International Solar Decathlon Competition

*By Terrance Malkinson, SAIT Polytechnic, Calgary*

Canadian post-secondary education institutions fared well at the U.S. Department of Energy's fourth biennial Solar Decathlon www.solardecathlon.org competition. Team Ontario/BC ranked fourth and team Alberta sixth out of a field of twenty international teams. Over 100,000 visitors toured the "solar village" located on the National Mall in Washington, D.C. during October 8-21, 2009.

Two years earlier, post-secondary educational institutions from around the world were invited to submit proposals to be considered for entry into the competition. Student teams who were successful then spent almost two years designing and building an approximately 800 square-foot home

powered exclusively from the sun using off-the-shelf technology. The goal was creating the best zero energy home. The competition required the homes to encompass all the ways that we use energy in our daily lives. Early in October, the students who will be our future engineers, architects, scientists, and entrepreneurs moved their homes to the National Mall for final assembly, evaluation and display to the public.

The Solar Decathlon itself has six major objectives:

* To educate student participants about the benefits of energy efficiency, renewable energy and green building technologies - information of value to their future career and to society.

* To raise awareness among the general public about renewable solar energy and energy efficiency.

* To encourage research and development of efficient energy utilization and production.

* To promote multidisciplinary collaboration among students.

* To promote an integrated approach to new construction that considers the interactions of all building components and systems.

* To demonstrate to the public the potential of energy efficient homes which produce as much renewable source energy as they consume.

Canadian teams placed well highlighting the excellence of our educational providers, and Canadian innovation expertise, applying solar energy to the growing industry of sustainable development.

## Team Ontario/BC
University of Waterloo, Ryerson University, Simon Fraser University

www.solardecathlon.org/2009/team_ontario_bc.cfm

Designed to be a "celebration of the small home" and to be light and airy, the Ontario/BC entry demonstrated a strong connection to the outdoors. It featured floor-to-ceiling windows on three sides, vertical PV panels, and one large multifunctional room in which nearly everything folded away when not needed. Capturing northern latitude winter sun was a key feature. Other important features included:

* An 11.9-kW PV system

* Evacuated-tube solar collectors integrated with cascading warm water storage tanks

* R-60 insulation

* Salt hydrate phase-change material in the floor

* Automated exterior shading for the floor-to-ceiling windows featuring louvers that tilt in one direction to shade the house interior and the other to let in the sunshine

* An extensive computer "living interface system" that allows residents to easily see and control their energy use and includes desktop, embedded, and mobile components

* A heat pump that rejects heat to a "cooling pond"

* Highly insulated, quadruple-glazed, floor-to-ceiling glass on south, east, and west sides for passive solar heating during northern winters and a connection to the outdoors

* External automated coverings on the glass to hold in heat at night and keep it out in summer

* Vertical PV panels that form a frame around the glass, plus rooftop PV panels, that are optimized for capturing winter solar energy

* Furnishings that fold away when not in use, including a bed that retracts to the ceiling and office space that hides completely

## Team Alberta
University of Calgary, SAIT Polytechnic, Alberta College of Art and Design, Mount Royal College

www.solardecathlon.org/2009/team_alberta.cfm

The Team Alberta house was designed in the rustic image of Western Canada on the outside with "post and beam timber frame" construction, and high-tech on the inside with a programmable logic controller operating heating, cooling, lighting, and entertainment. Key features included:

* Electrical production from a 7.6-kW crystalline silicon photovoltaic system mounted on two tilted rooftop structures separated by a rooftop terrace

* R-44 insulation from structural insulated panels

* Heating and cooling by a solar-assisted, ground-source heat pump with both air-side and water-side economizers

* An exterior that integrates local wood, stone, and other materials

* A programmable logic controller and numerous inside and outside sensors

* Separate public and private halves with activity areas in each

* LED lighting designed to provide interesting visual effects and accent artwork designed into the home

*Congratulations from IEEE Canada to all involved!*

# The Bold and the Brave

## Interview with Dr. Monique Frize, Professor and Author

*By*    *Jennifer Ng Ain Kin, WIE Ottawa Chair*
*photos by Barbora Dej*

**The Bold and the Brave** by Dr. Monique Frize, professor at Carleton and Ottawa universities, tells the story of women who strived and succeeded to achieve careers in science and engineering. It outlines obstacles that were faced - and some that are still present, the context and concepts, the history and especially the lives of three remarkable women: Sophie Germain, Mileva Einstein, and Rosalind Franklin.
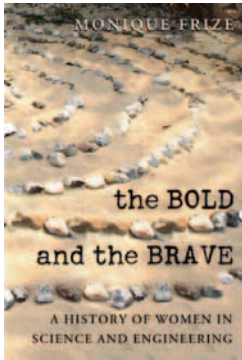
Dr. Frize concludes with an insightful examination of the place of women in the science and engineering arena. She proposes to 'regender' the fields by integrating feminine and masculine approaches; this would encourage more young women to pursue technical careers and could bring a new energy to science and engineering.

The book, edited by Les Presses de l'Université d'Ottawa / Ottawa University Press, was launched December 1st 2009 at the University of Ottawa, where Dr. Frize was surrounded by family, friends, colleagues and fans.

Q   Is there an engineering domain today which one has to be brave & bold to tackle?

A   I think most would require a woman with confidence, who believes in herself. But perhaps biomed and environmental are a little easier for women than say, mining or construction, petroleum, etc.

Q   Any particular advice for today's young female engineer?

A   Believe in yourself! And find good mentors at each stage of a career. Jump over hurdles and you will reach your goals. Pick your battles carefully and sleep 24 hours prior to responding to a conflict by letter or at a meeting (except if an immediate response is needed).

Q   Any particular advice for today's young male engineer?

A   You need to see the value in feminine attributes and respect your female colleagues. Everyone has their talents and skills and it is important to value the contributions from people who are different from us. You can be part of the solution to build a balanced world of engineering and technology.

Q   Anything else that you would like our IEEE Canada readers to know about your book?

A   Everyone can find something in the book that they can do to move towards an engineering profession that is more balanced and that respects everyone's perspectives and contributions. The book will hopefully also help mothers, fathers, uncles and aunts to open up opportunities for the girls in their family to consider more career choices, including engineering!

During her speech, Dr. Frize had a special mention for the young women who fell victim of a deranged murderer at École Polytechnique de Montréal twenty years ago: "…and I wanted to remember the fourteen women who died at Polytechnique for wanting to become engineers…I think that it is very appropriate that we can remember those women and think about some of the things in the book and what we can do to remember them and also (how) to push progress forward."



Dr. Monique Frize (middle with book in hand) surrounded by her fans - members of Women in Engineering (IEEE-WIE) and Women in Science and Engineering (WISE)

Q   What was the most challenging part of the book to write? What was the easiest?

A   The first two parts (philosophy and history) were the most difficult as I had to find all the material from sources that I had not seen before. The contemporary part was the easiest, having done 20 years of work on women in science and engineering through the two Chair positions I held (Northern Telecom/NSERC Women in Engineering Chair at the University of New Brunswick, then the NSERC/Nortel Chair for Women in Science and Engineering at the University of Ottawa and Carleton University).

Q   If you had not studied engineering, what would have been your alternate choice?

A   Medicine was my other choice.

Q   If you restarted your engineering studies today, what specialties would catch your attention?

A   The same: Electrical Engineering and then Biomedical Engineering.



*Left to Right:*
Dr. Monique Frize, Jennifer Ng Ain Kin

# Engineering Management: *What's New in the Literature?*

On Mobile Money, Business during Uncertainty, Retirement and Entrepreneurship, Education, Social Responsibility of Business, Information Overload, and Risk.

*by   Terrance Malkinson*
*School of Health and Public Safety*
*SAIT Polytechnic, Calgary, Alberta*

◆ The cover story in The Economist (392: #8650. September 26, 2009. www.economist.com) is a special 19-page report on telecoms in emerging markets - "The Power of Mobile Money". Adoption of mobile communication technologies is a high growth area in the developing world; even more so than in the developed world. Interestingly, one reason for this is that these developing markets are bypassing wired infrastructure and jumping directly to wireless, providing access to telecommunications for the first time to many of their people. The articles focus on how new communication technologies are beneficially transforming developing countries. In the report's introduction it is stated that every ten mobile phones introduced per 100 people boosts growth in GDP per person by 0.8 percentage points. Growth opportunities including the rise of home grown mobile operators, telecom equipment maker growth, and the development of new phone-based services are discussed.

◆ The global recession has caused many of us to re-examine our personal priorities and caused many organizations to re-examine their business planning. In "How to Rethink your Business during Uncertainty" (MIT Sloan Management Review, 50(3): 25-30, Spring 2009. www.sloanreview.mit. edu), Rita McGrath and Ian MacMillan discuss the importance of re-assessing your core business and implementing changes to ensure a sustainable future. Three best practices that will help you keep your core business relevant are provided. General Electric's Chairman and CEO Jeff Immelt discusses his beliefs and insights in "the reset world" where business realities are now different and the rules of the game have changed (Canadian Business, 82:(12/13):10-11, August 17, 2009. www.canadian-business.com). For those who are looking at employment opportunities, Nancy Schullery, Linda Ickes and Stephen Schullery provide the results of their research of employers' preferences for resume style and delivery ("Employer Preferences for Resumes and Cover Letters", Business Communication Quarterly, 72(2): 163-176. June, 2009. www.businesscommunication.org). The authors provide important insights for the job seeker into current best practices.

◆ A series of articles on the topic of retirement financial security is provided in Canadian Business (82(12/13):60-78. August 17, 2009. www.canadianbusiness.com). The authors discuss the looming retirement crisis and provide strategies that you might consider to secure your future. Not ready to retire? An Ipsos Reid poll (February 18, 2009) indicates that economic conditions are causing many boomers to delay retirement. - Jennifer Wong discusses how many 50+ people are considering transitioning to self-employment ("Not Ready to Retire?" Entrepreneur, 37(3): 71-79, March, 2009, www. entrepreneur.com). The author describes advantages of self-employment including having more control and flexibility over their life and the opportunity to pursue personal dreams, and an inset of Ipsos Reid polling reveals that 32% of boomers intend to finance their business start-up with their savings. "How to Build Your Dream Company" (Inc. 31(6):62-76. July/August, 2009. www.inc.com) presents ten examples of entrepreneurial individuals who successfully made the transition and factors to consider before making the move to self-employment.

◆ Frank Caccavo believes that it is important to incorporate research into undergraduate curricula. The approach is discussed in "Teaching Undergraduates to Think Like Scientists" (College Teaching, 57(1): 9-14, Winter 2009. www.heldref.org/pubs/ct/about.html). Implementation approaches include faculty-directed research projects across academic disciplines, off-campus internships, and research-oriented courses. This scientific, inquiry-based learning of practical information will help them choose a career path and succeed professionally. Seyfi Kenan discusses the importance of values education in "The Missing Dimension of Modern Education: Values Education" (Educational Sciences: Theory and Practice. 9(1):279-

295. Winter, 2009. www.edam.com.tr/kuyeb/en). The article examines assumptions shaping education and how values education has importance in providing students with the skills to deal with current societal problems. Joel Podolney in the article "The Buck Stops (and Starts) at Business School, (Harvard Business Review. 87(6):62-87. June 2009. www.hbr.org) suggests that business schools need to make radical change; becoming part of the solution rather that part of the problem. The author provides suggestions for change graduating students who take a holistic approach to business issues.

◆ The social responsibility of business is a matter of continuing debate. Often business is viewed as an activity designed to create private wealth without regard to non-economic considerations such as ethics, social issues and the environment. In "Can Multinational Corporations Afford to Ignore the Global Common Good?" (Business and Society Review. 114(2): 153-182, 2009. http://www.wiley.com/bw/journal.asp?ref=0045-3609&site=1) Henri-Claude De Bettignies and Francois Lepineux discuss the relationship between international business and the global common good. They examine three interconnected evolutions which they believe are likely to induce multinational corporations to take the global common good into account.

◆ Many of us are increasingly overwhelmed by information—some worthwhile—most, simply distracting. Organizational and peer pressure often makes us feel inadequate if we are not instantly "on top" of new information. Information is difficult to manage effectively even with technology. In "Death by Information Overload" (Harvard Business Review, 87(9): 83-89, September 2009, www.hbr.org), Paul Hemp discusses practical ways for individuals and organizations to "subdue the multi-headed monster of information overload". Hemp discusses the problem from both individual and from organization perspectives and provides you with strategies to manage information effectively.

◆ In a series of five articles, the October 2009 issue of Harvard Business Review (87-10) discusses risk. Articles include "Managing Risk in the New World", "Mapping Your Fraud Risks", "The Six Mistakes Executives Make in Risk Management", "How Vulnerable is your Business to Consumer Debt?", and "Making the Financial Markets Safe". In the lead article, five experts discuss in a HBR roundtable the future of enterprise risk management, addressing many important questions. In Corporate Governance Quarterly (16-20. Summer, 2009. www.icsacanada.org), Tamara Bekefi, Marc Epstein and Kristi Yuthas discuss the importance of balance - looking at both risk and opportunity together in an approach that will facilitate success in the challenging business environment. A risk and opportunity management process is provided.

## About the Author

**Terrance Malkinson** is a communications specialist, business analyst and futurist. He is Vice-Chair of the IEEE-USA Communications Committee, an international correspondent for *IEEE-USA Today's Engineer Online*, editor-in-chief of *IEEE-USA Today's Engineer Digest*, and an associate editor for *IEEE Canadian Review*. He was an elected Senator of the University of Calgary and an elected Governor of the IEEE Engineering Management Society as well as an elected Administrative Commitee member of the IEEE Professional Communication Society. He has been the editor of several IEEE conference proceedings, and past editor of *IEEE Engineering Management*. Currently, he is with the School of Health and Public Safety/Applied Research and Innovation Services at SAIT Polytechnic in Calgary, Canada.
malkinst@telus.net

## WEST...

IEEE IAS Electrical Safety, Technical and Mega Projects Workshop (ESTMP)

2010-03-29...31, Calgary, AB

http://ewh.ieee.org/soc/ias/tmp

**23rd Canadian Conference on Electrical and Computer Engineering (CCECE 2010)**

2010-05-02...05, Calgary, AB
http://www.ieee.ca/ccece10/

23rd Canadian Conference on Electrical and Computer Engineering (CCECE)

2010-05-02...05, Calgary, AB

http://www.ieee.ca/ccece10

IEEE Int'l Communications Quality and Reliability Workshop (CQR)

2010-05-08...10, Vancouver, BC

http://www.ieee-cqr.org

IEEE Int'l Conference on Intelligence and Security Informatics (ISI)

2010-05-23...26, Vancouver, BC

http://conferences.irmacs.sfu.ca/isi2010

## CENTRE...

25th Biennial Symposium on Communications (QBSC)

2010-05-12...14, Kingston, ON

http://www.ece.queensu.ca/apps/symposium

5th Int'l Conference on Digital Information Management

2010-07-05...08, Thunder Bay, ON

http://www.icdim.org

IEEE Int'l Symposium Antennas and Propagation and CNC/USNC/URSI Radio Science Meeting

2010-07-11...17, Toronto, ON

http://www.apsursi2010.org

6th IEEE Int'l Conference on Automation Science and Engineering (CASE)

2010-08-21...24, Toronto, ON

http://www.case2010.org

IEEE/WIC/ACM Int'l Conferences on Web Intelligence and Intelligent Agent Technology (WI-IAT)

2010-08-31...09-03, Toronto, ON

http://www.yorku.ca/wiiat10

## EAST...

IEEE Int'l Workshop on Medical Measurements and Applications

2010-04-30...05-01, Ottawa, ON

http://memea.ieee-ims.org

IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB)

2010-05-02...05, Montreal, QC

http://www.cibcb.org/CIBCB10

8th Annual Communication Networks and Services Research Conference (CNSR)

2010-05-11...14, Montreal, QC

http://www.cnsr.info/2010

IEEE Int'l Symposium on "A World of Wireless, Mobile and Multimedia Networks" (WoWMoM)

2010-06-14...17, Montreal, QC

http://wowmom2010.netgroup.uniroma2.it

8th IEEE Int'l NEWCAS Conference

2010-06-20...23, Montreal, QC

http://newcas.grm.polymtl.ca

14th Int'l Symposium on Antenna Technology and Applied Electromagnetics (ANTEM) and the American Electromagnetics Conference (AMEREM)

2010-07-05...09, Ottawa, ON

http://antem.ee.umanitoba.ca/antem_amerem2010

IEEE/ASME Int'l Conf. on Advanced Intelligent Mechatronics

2010-07-06...09, Montreal, QC

http://cost.georgiasouthern.edu/aim2010

3rd Int'l Conference on Wireless Communications in Underground and Confined Areas (ICWCUCA)

2010-08-23...25, Val-d'Or, QC

http://www.icwcuca.ca

**4th Annual Electrical Power and Energy Conference (EPEC 2010)**

2010-08-23...25, Halifax, NS
http://www.ieee.ca/epec10/

IEEE Vehicular Technology Conference (VTC-Fall)

2010-09-12...15, Ottawa, ON

http://www.ieeevtc.org

1st Int'l Conf. on Applied Robotics for the Power Industry (CARPI)

2010-10-05...07, Montreal, QC

http://www.carpi2010.org

IEEE Topical Meeting on Microwave Photonics (MWP)

2010-10-05...09, Montreal, QC

http://www.mwpconference.org

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# IEEE Canada

# CCECE 2010
## 23rd Annual Canadian Conference on Electrical and Computer Engineering
### May 2–5, 2010, Calgary, Alberta, Canada
### http://www.ccece2010.org

*"Evolution of Theory: Bringing Theory and Technology into Application"*

The 2010 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE 2010) will be held in Calgary, Alberta, Canada from May 2-5. CCECE 2010 provides a forum for the presentaùon of electrical and computer engineering research and development from Canada and around the world.

The conference will be structured into six mini-symposia in the areas of:

- Circuits, Devices and Systems
  *Chairs: Dr. P. Valizadeh, Dr. G. Cowan*

- Control and Robotics
  *Chair: Dr. Javad Lavaei, Danilo Ramos*

- Communications and Networking
  *Chair: Dr. Yousef Shayan*

- Computers, Software and Applications
  *Chair: Vincent Chiew*

- Power Electronics and Energy Systems
  *Chair: Dr. Amirnaser Yazdani*

- Signal and Multimedia Processing
  *Chair: Dr. Dongliang Huang*

## Important Dates

Authors' Registration ends by:    Friday, March 26, 2010

Advance Registration ends by:    Friday, April 23, 2010

## Industrial Exhibits and Sponsorships

For industrial exhibits please contact the Industrial Exhibits Chair at exhibits@ccece2010.org

For sponsorships please contact the Sponsorship Chair at sponsorship@ccece2010.org

## Questions or Comments

For any questions or comments, please contact the Conference Chair: Rob Anderson. Phone: 509 939-5641 Fax: 509 241-6153 Email: rlanderson@ieee.org

# CCGEI 2010

## 23ième Conférence canadienne annuelle de génie électrique et informatique

### 2–5 mai 2010, Calgary, Alberta, Canada

http://www.ccece2010.org

### « Évolution de la théorie : Mettre la théorie et la technologie en application »

La conférence canadienne de génie électrique et informatique de l'IEEE 2010 (CCGÉI 2010) se tiendra à Calgary, Alberta, Canada le 2-5 mai . La CCGÉI 2010 fournit un forum pour la présentation de la recherche et développement en génie électrique et informatique au Canada et partout dans le monde.

La CCGEI 2010 offrira six mini recueils d 'articles représentant une gamme diverse de génie électrique et informatique:

- Circuits, dispositifs et systèmes
  *Président : Dr. P. Valizadeh, Dr. G. Cowan*
- Commande et robotique
  *Président : Dr. Javad Lavaei, Danilo Ramos*
- Communications et gestion de réseau
  *Président : Dr. Yousef Shayan*

- Ordinateurs, logiciel et applications
  *Président : Vincent Chiew*
- L'électronique de puissance et sytèmes énergétiques
  *Président : Dr. Amirnaser Yazdani*
- Signal et traitement multimédia
  *Président : Dr. Dongliang Huang*

## Dates importantes

Inscription des auteurs avant :   Vendredi le 26 mars 2010

Inscription anticipée avant :   Vendredi le 23 avril 2010

## Expositions industrielles et parrainage

Pour les expositions industrielles, veuillez contacter: exhibits@ccece2010.org

Pour des parrainages, veuillez contacter sponsorship: sponsorship@ccece2010.org

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