

IEEE

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Canadian Review

La revue canadienne de l'IEEE

**IEEE
CANADA
AWARDS**



**Achievement
& Service**

**IEEE
Fellows**

EIC Fellows

**Writing is
Good for
Your Career**

**Active
Infrared
Thermography**

**Medium Voltage
Drive for Oil
Sands Applications**



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IEEE Canada

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The *IEEE Canadian Review* is published 3 times/year as follows: Spring (to appear in April-May), Summer (to appear in August-September), and Fall (to appear in December). 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 | 4- Education | 7- Computers |
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| 3- Industry | 6- Communications | |

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Eric Holdrinet SMIEEE, Rédacteur en chef / Managing Editor

Ce numéro spécial de la Revue inclut le livret complet des Prix de l'IEEE Canada qui seront présentés début-mai à la Conférence canadienne de génie électrique et informatique à Niagara Falls, Ontario. Cela suit la présentation plus tôt dans l'année des Prix de l'Institut canadien des ingénieurs, duquel le IEEE Canada est une composante majeure (www.eic-ici.ca).

En parcourant la liste des lauréats, vous noterez qu'une forte proportion des prix sont décernés à des membres ne provenant pas de la recherche universitaire – incluant le prix le plus prestigieux du IEEE Canada, la Médaille d'or McNaughton, conférée à Dr. Colin Franklin pour ses travaux innovants dans le programme du satellite Alouette. Encore récemment, on faisait remarquer que le processus des récompenses proférerait un avantage inhérent aux membres du domaine académique qui pouvait consacrer une plus grande portion de leur temps à la recherche pure. Le IEEE et sa composante canadienne ont pris bonne note et reconnaissent davantage l'importance du travail pionnier effectué dans des contextes d'entreprise et gouvernementaux. Une nouvelle catégorie nommée « Ingénieur d'application / Praticien » a même été introduite il y a quelques années dans le programme des Fellows IEEE. Consultez www.ieee.org/fellows, et proposez la candidature d'un(e) collègue particulièrement méritant(e).

Deux articles principaux dans ce numéro présentent des applications industrielles d'intérêt particulier pour les membres canadiens : *Active Infrared Thermography with Applications* examine un éventail de techniques thermographiques dans un contexte canadien : des pièces d'avion CF18, payées avec vos taxes. Des inspections attentives et efficaces – et donc possiblement plus fréquentes – aideront à garder ces avions en opération et nos pilotes en sécurité.

A Medium Voltage AC Drive for Oil Sands Applications, écrit par trois ingénieurs de Rockwell Automation (Dundas, ON) est un sujet aussi canadien que celui des pompes électriques pour la production de sirop d'érable, quoique peut-être un peut plus visqueux. Notre publication est ouverte à des articles de l'industrie, du moment qu'ils soient d'excellente qualité technique et bien écrits.

... parce qu'une bonne communication est importante pour nous, et aussi pour vous. Notre chroniqueur Terry Malkinson propose dans cette revue que *l'Écriture est bonne pour votre carrière (Writing is Good for your Career)*; il présente des arguments convaincants en ce sens et propose une méthode succincte sur comment procéder. Si j'étais vous je lirais cette chronique et ensuite composerais un article pour la Revue canadienne de l'IEEE, deviendrais un grand communicateur, un leader technique réputé, et récolterais les lauriers.



IEEE Canada Awards can be inspected in detail at <http://www.ieee.ca/awards>; no need to submit them to *Active Infrared Thermography*.

This special issue of the Review includes the full booklet of IEEE Canada Awards to be presented early May 2008 in Niagara Falls, Ontario at the Canadian Conference on Electrical and Computer Engineering. This follows the presentation earlier in the year of Awards from the Engineering Institute of Canada, of which the IEEE Canada is a major component (see www.eic-ici.ca).



Browsing the list of laureates, you may notice that a good proportion of awards are presented to members from outside university research – including the highest IEEE Canada award, the McNaughton Gold Medal, to Dr. Colin Franklin for pioneering work in the Alouette satellite program. Not so long ago, it was remarked that the awards process provided an inherent advantage to members from academia who could devote a larger portion of their career to pure discovery. The IEEE and its Canadian component have taken note and recognize more than ever the importance of ground-breaking work happening in industry and government settings. A new category called “Application Engineer / Practitioner” was even introduced a few years ago to the IEEE Fellows program. Look under www.ieee.org/fellows, and consider nominating a particularly deserving colleague.

Two feature articles in this publication present industry applications of particular interest to Canadians: *Active Infrared Thermography with Applications* looks at a cross-section (appropriately) of such techniques, in a Canadian context: bits and pieces of CF18 aircraft, paid for with our taxes. Careful and cost effective – and therefore more frequent – inspections will help keep these planes aloft and our pilots safe.

A Medium Voltage AC Drive for Oil Sands Applications, written by three engineers from Rockwell Automation (Dundas, ON) is a subject as Canadian as electric pumps for maple syrup production, if a bit stickier. Our publication does welcome articles from the industry, as long as they are of excellent technical quality and well-written.

... Because good communication is important for us, and for you. Our columnist Terry Malkinson posits in these pages that *Writing is Good for your Career*, presents convincing arguments for why this is so, and offers a short recipe on how to go about it. If I were you I would read this column and then compose an article for the IEEE Canadian Review, become a great communicator, a recognized technical leader, and reap the awards.

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Dear Colleagues, as I started recently my term of office as Region 7 Director and President of IEEE Canada for 2008–2009, I wish to thank you all for the strong support that you have given me during my election time. Also, I would like to express my sincere thanks for those who served, in particular Bob Hanna and his team of volunteers for their contributions to IEEE Canada. A superb and well done job by all. In the mean time I would like to welcome Om Malik, our Director-Elect and the new team of volunteers to serve IEEE Canada; we are lucky to have such a motivated and devoted group.

I just wanted to share with you my short term goals which I hope we can achieve together during 2008.

The IEEE Section Congress' 2008 Related Goals are the highlights of the year. IEEE Canada will showcase its achievements over the past twenty five years at a Sections Congress 2008 that will bring us in Quebec City a representation of over 300 IEEE Sections worldwide with total participation of over 1000 guests. I am appointing a Task Force to work with Section leaders to identify and document major achievements at the Section and Regional levels such as Milestones, Awards...etc. I would like to see the Region create a brochure and posters that will be made available for all participants at Sections Congress. In addition, IEEE Canada will celebrate the achievements of its volunteers by creating a commemorative pin to be awarded in 2008 to key leaders identified by our Region, Areas, and Sections.



On the Training and Professional Development side, I note that 2008 is the first year of the transition of our Regional Activities Board to one which is focused on members and their needs. We will sponsor a major one-day training session for our Regional Committee members at the up-coming Spring Meeting to explain in detail the actions and desired outcomes from the Members Geographical Activities Board (MGAB). The training will be lead by the creators of the model who will articulate its aims, objectives, and key implementation highlights.

IEEE Educational Activities Board's Professional Trainers will be conducting two days of Teachers Workshops during the summer of 2008. We expect to involve school guidance counselors, high school students and interested engineers.

Regarding Professional Development Presentations, we are considering the production of a DVD incorporating first rate professional productions of up to five presentations. The Distinguished Speakers Tours will be continued with the target being three tours for the Region in 2008. Each Area is requested to complete one tour during the year. And we need to continue offering at least three Webinars during the year 2008.

Regarding Members Benefits: We need to continue our efforts regarding IEEE Canada Senior Members Elevation for 2008. I believe that a goal of 150 member elevations is achievable. Also, IEEE Canada should aim to equal or exceed this past year's excellent representation of 12 candidates awarded the Fellow Grade from the ranks of its Senior Members. A summary of IEEE Canada's Fellow Class of 2007 can be found in this publication.

The 2008 IEEE Canada Conference on Electrical and Computer Engineering (CCECE'08) will take place at Niagara Falls, Ont., May 4-7, 2008. Visit the Conference Website: (<http://www.ccece08.org>). I look forward to see you there and celebrate with you our achievements at the Gala Awards Dinner.

Cher collègues, alors que j'ai entamé récemment mon mandat comme Directrice Région 7 et Présidente de l'IEEE Canada pour 2008-2009, je désire vous remercier pour l'appui considérable que vous m'avez prodigué durant l'élection. Aussi, je désire exprimer mes sincères remerciements à ceux qui ont servi la Région, en particulier Bob Hanna et son équipe de bénévoles pour leur contribution au IEEE Canada. Un travail superbe et bien exécuté par tous. En attendant je souhaite accueillir Om Malik, notre Directeur-Élu et la nouvelle équipe de bénévoles au service du IEEE Canada; nous sommes fortunés d'avoir un groupe aussi motivé et dévoué.

Je désire partager avec vous les buts à court terme que j'espère nous atteindrons ensemble en 2008.

Le buts reliés au Congrès des Sections IEEE 2008 constituent le point culminant de l'année. Le IEEE Canada présentera ses réalisations des derniers vingt-cinq ans à ce Congrès qui assemblera à Québec une représentation de plus de 300 Sections du IEEE à travers le monde, avec une participation totale de plus de 1000 délégués.

J'ai désigné un groupe de travail pour œuvrer avec les dirigeants de Sections dans l'identification et la documentation des réalisations majeures aux niveaux des Sections et de la Région, tels les Bornes (« Milestones »), Prix, etc. Je voudrais que la Région conçoive une brochure et des posters qui seront disponibles à tous les participants au Congrès des Sections. De plus, l'IEEE Canada célébrera les réalisations de ses bénévoles en créant une épinglette commémorative qui sera décernée en 2008 aux leaders clés identifiés par la Région, les Zones (« Areas ») et les Sections.

Du côté Formation et Développement Professionnel, je note que 2008 est la première année de transition pour notre Commission des activités régionales (« Regional Activities Board ») vers un rôle dédié aux membres et leurs besoins. Nous allons offrir une importante journée de formation aux membres du Comité régional à la prochaine Réunion du printemps pour expliquer en détails les actions et résultats désirés par le nouveau Comité des activités géographiques et pour les membres (Members Geographical Activities Board - MGAB). Cette formation sera donnée par les concepteurs du modèle; ils spécifieront ses buts, objectifs, et éléments clés d'implantation.

Des formateurs professionnels de la Commission d'activités éducationnelle du IEEE donneront deux jours d'« Ateliers pour enseignants » à l'été 2008. Nous espérons impliquer des conseillers d'orientation scolaire, des étudiants du secondaire et collégial, et des ingénieurs intéressés.

En ce qui concerne les Présentations de développement professionnel, nous envisageons une production de haut niveau d'un DVD incorporant jusqu'à cinq présentations. Les Tournées de conférenciers distingués continueront avec comme objectif trois tournées pour la Région en 2008. Chaque Zone de la Région doit offrir une Tournée durant l'année. Et nous devons continuer d'offrir au moins trois webinaires durant l'année 2008.

Concernant les bénéfiques aux membres: Nous devons continuer nos efforts concernant la promotion des Membres seniors au IEEE Canada pour 2008. Je crois que le IEEE Canada devrait viser à égaler ou dépasser l'excellent résultat de l'an dernier avec 12 candidats élus au grade de Fellow parmi ses Membres Seniors. Un résumé de la Promotion 2007 des Fellow du IEEE Canada est présenté dans cette publication.

La Conférence canadienne de génie électrique et informatique IEEE 2008 (CCGEI'08) se tiendra à Niagara Falls (Ontario) du 4 au 7 mai 2008. Visitez le site web <http://www.ccece08.org>. J'ai hâte de vous y rencontrer et célébrer avec vous nos réalisations au Banquet de remise des prix.

Le Bulletin d'information électronique du IEEE Canada se poursuivra sur une base mensuelle et se penchera sur vos nouvelles d'importance et l'échange d'information. Veuillez fournir à son éditeur

The IEEE-Canada Electronic Newsletter will be produced on a monthly basis and will focus on your important news and information exchange. Please provide the Newsletter Editor with your articles and news items. The publication of The IEEE Canadian Review will proceed at three issues per year. This also needs your participation by submission of articles to the Editor for consideration. A message from an Area Chair as well as from a Committee Group Chair in addition to the President's message will be included in each issue. Please pay close attention to the cut-off dates.

I look forward to your suggestions and to work with you as a team to achieve our goals to make IEEE Canada the best region in IEEE.

Wish you all the best. ■

vos articles et nouvelles. La publication de la Revue canadienne de l'IEEE se poursuivra aussi au rythme de trois numéros par an. Nous avons aussi besoin de votre participation pour la soumission d'articles au Rédacteur en chef. Un message d'un Président de Zone ainsi que d'un Président de Groupe de comités en plus du Message du Président seront inclus à chaque numéro. Veuillez porter attention aux dates de tombées.

J'ai hâte d'obtenir vos suggestions et de travailler avec vous en équipe pour atteindre nos buts et faire de l'IEEE Canada la meilleure région de l'IEEE.

En vous souhaitant une excellente année. ■

Ferial El-Hawary, P.Eng., FIEEE, FEIC, FMTS

IEEE Canada members swell the ranks of honourees at EIC Gala Dinner

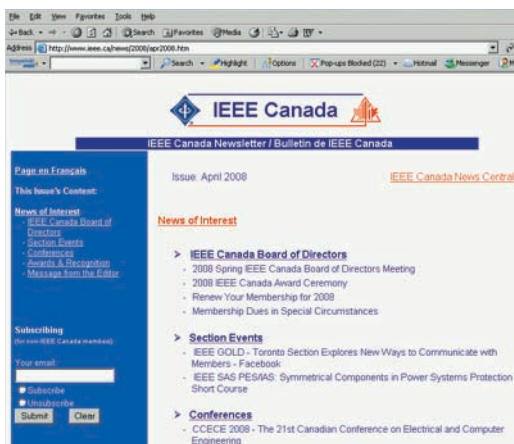


A proud moment for the Engineering Institute of Canada's 2008 award laureates present at this year's ceremony. For the full list, including the 12 IEEE Canada honourees, please visit the website <http://www.eic-ici.ca>

IEEE Canada is seeking an Electronic Newsletter Editor

IEEE Canada is seeking a member volunteer willing to take this charge which is currently vacant. Electronic Newsletters are produced monthly as a service to our members to quickly inform our community of news and events of interest.

Contact admin@ieee.org



The Electronic Newsletter is also posted on-line for the benefit of our engineering colleagues in other disciplines as well as for students and other interested parties.

IEEE Canada cherche un Rédacteur en chef pour son Infolettre

IEEE Canada cherche un(e) volontaire intéressé(e) à occuper ce poste qui est présentement vacant. Les Infolettres sont produites mensuellement en tant que service aux membres pour informer rapidement notre communauté sur les nouvelles et événements d'intérêt.

Contactez admin@ieee.org



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Send any news clippings you would like to contribute via e-mail to alexandre.abecassis@ieee.org

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

DENVER, CO. Dec. 20, 2007. MPEG LA has announced that it has commenced an action against Audiovox Electronics for breach of contractual obligations as a licensee to MPEG-2 patent portfolio and 1394 patent portfolio. MPEG LA states that Audiovox Electronics has failed to report certain of its products that use the MPEG-2 compression standard or employ an interface with the IEEE 1394 standard.

MONTREAL, QC. Dec. 20, 2007. Sipro Lab Telecom, the administrator of the G.729 patent pool, a famous communication standard developed by France Telecom, Nippon Telegraph and Telephone Corporation, Mitsubishi Electric Corporation, and Université de Sherbrooke, has announced today that the patent royalty pricing options available to end-product manufacturers will be modified as of January 1st, 2008. The options for licensees will be simplified. The consortium has been active now for more than nine years.

MONTREAL, QC. Feb. 28, 2008. Nstein Technologies Inc., a provider of online publishing solutions for printed publications and online content providers, has announced that Libération, a famous French daily newspaper founded by Jean-Paul Sartre in 1973, has selected Nstein's Web Content Management and Text Mining Engine solutions. Those solutions will be used to implement Libération's new "web 2.0"

website and develop a platform for user-driven content.

QUEBEC CITY, QC. Feb. 13, 2008. The Société de protection des forêts contre le feu (SOPFEU) has announced today that it has selected Amadeus International software for the management of its documentation, corrective and preventive actions (CAPA), audits, nonconformance and complaint management. The solution selected provides a Web architecture that enables organizations to comply with ISO standards and regulations, GxP, 21 CFR Part 11 as well as other industry standards.

MONTREAL, QC. Feb. 12, 2008. Cision has announced today the launch of the French language version of its interactive media analysis solution. The solution is designed

to advance how organizations gauge the impact of their media coverage and shape communications activities to help build stronger corporate reputations. The analysis is presented in graphical charts and reports that evaluate the effectiveness of a campaign or trends over a given period of time.

OTTAWA, ON. Jan. 21, 2008. March networks, a provider of intelligent IP video and business analysis applications has announced that it has been ranked the second largest supplier of video surveillance equipments in the North American retail market. March networks has a six-percent share of a \$437 million market that is expected to grow to \$586 million by 2011.

TORONTO, ON. Jan. 15, 2008. Tokiva has announced today the public launch of its Mobile Communications Platform that provides open and cost effective voice, messaging, and sharing services on Mobile, Web, and Instant Messaging systems. Tokiva operates as a mobile virtual network operator (MVNO) that provides value-added communication services to global travelers. The goal of Tokiva is to build an open platform that makes mobile communication universally accessible, useful and affordable.

WINNIPEG, MB. Mar. 18, 2008. The city of Winnipeg and Affiliated Computer Services have announced a contract to operate an intersection safety camera program for the city of Winnipeg. The contract has a

value of \$25 million with options for future years. The city of Winnipeg has been the first jurisdiction in Canada to use intersection safety cameras to address both red lights turning and speeding at intersections.

TORONTO, ON. Mar. 4, 2008. Sirit, a company that provides radio frequency technology identification (RFID) technology has announced that an agreement has been signed to acquire RSI ID technologies which is manufacturing antennas, inlays and tags for specialized passive RFID applications.

MONTREAL, QC. 24 mar. 2008. SR Telecom a annoncé que la majorité de ses actifs va passer aux mains du Groupe Lagassé. Le Groupe Lagassé va acheter notamment les marques de commerce, les brevets, les inventaires et les équipements en relation avec la gamme de produits symmetryMX. SR Telecom a été placée sous la protection de la Loi sur les arrangements avec les créanciers des compagnies en novembre 2007.

MONTREAL, QC. Feb. 28, 2008. CAE has announced the signing of contracts worth \$52 million with Lufthansa Flight

Training and Xiamen Airlines to design and manufacture four full flight simulators. More precisely, Lufthansa Flight Training has ordered an Airbus A320 full-flight simulator (FFS) and a Boeing 747-8 Intercontinental simulator while Xiamen Airlines has ordered two Boeing 737-800 simulators along with a suite of CAE Simfinity training devices.

LEVIS, QC. Feb. 6, 2008. Creaform has announced today the acquisition of ActiCM, a French-based specialist in the manufacture and marketing of three-dimensional measurement systems. ActiCM has developed a photogrammetry-based technology that allows three-dimensional control of manufactured parts using images of the object to be controlled. This technology may be used in the automotive and aeronautics fields.

OTTAWA, ON. Jan. 25, 2008. Lockheed Martin has today announced contract commitments to companies in Ontario that will lead to placing work with at least \$175 million in the region. This is a result of the company's industrial benefits obligation to Canada arising from the government's purchase of 17 C-130J Super Hercules aircraft. ■

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A View from the West

On: Canada's Best Employers, Jobs, Trends, Aviation, Floods, Power Lines, and the Need for Speed

By *Terrance Malkinson*
Senator, University of Calgary

- ◆ Results from the ninth annual ranking of Canada's best employers are published in *The Globe and Mail's: Report on Business*. ["50 Best Employers in Canada", Steve Brearton, 24(6):45-57. January, 2008. www.globeandmail.com/robmagazine]. Leading this ranking is Ellisdon Corporation, an international construction firm founded in 1951 and run by the Smith family of London, Ontario. The reasons for their ranking as #1 employer are basic - respect your employees. In a recent Hewitt study 94% of EllisDon employees said they would high recommend the company to their friends and 91% rated their future prospects with the company as good. A very insightful report on their employee's-first philosophy follows the ranking (pp. 48-53). "EllisDon has created and nurtured a culture that is right for them" says Neil Crawford who headed the Hewitt study (www.hewitt.com/bestemployerscanada).



- ◆ Looking at British Columbia the annual ranking of "The Best Companies to Work for in BC" is provided in *BC Business*. [35(12): 37-45, 2007 www.bcbusinessonline.ca] Leading the list for companies with fewer than 100 employees is Chemistry Consulting Group, Inc. (GT Hiring Solutions) and for companies with more than 100 employees the leader is Next level Games Inc. A survey "Alberta's Best Workplaces 2008" [12(30):25-43. March, 2008] looks at companies from the employee's point of view and discusses innovative human-resources practices that employers are using to compete for the best talent for their organization. In "The Best and Worst of 2007". [11(12):87-98. December, 2007] the Editors provide the top 10 Alberta business stories of the year.
- ◆ Several articles focusing on the Alberta job market are available in *Alberta Venture* [www.albertaventure.com]. Information on the fastest growing firms in Alberta is provided by Tom Keyser in "The Fast 50" [12(10):29-43. January, 2008]. Categories of growth included revenues, assets, and employees for organizations of various sizes. Twenty of these fastest-growing companies represented oil and gas or oilfield service companies.
- ◆ "Canadian Social Trends" is an on-line publication of Statistics Canada that discusses the social, economic, and demographic changes affecting the lives of Canadians. (www.dsp-psd.pwgsc.gc.ca/Collection-R/Statcan/11-008-XIE/11-008-XIE.html). Information includes the latest figures for major social indicators. Topics in the Winter, #84, 2007 issue include: re-accreditation and the occupations of immigrant doctors and engineers; delayed transitions of young adults, and Census snapshots of Canada.
- ◆ In Manitoba, flooding from the Red River has caused considerable damage and hardship for many years. After a devastating flood in 1950 the provincial government championed the construction of a diversion system to mitigate the risk of another flood. This plan was completed in 1968 and it is estimated that the floodway has saved the province more than \$8B in potential flood damage. The government has now embarked on a program of expansion of the floodway to protect Manitobans for a 1-in-700 year flood protection plan. The story is provided in "Floods and Fortitude" [*Commerce & Industry Magazine*. 56(6): 10-20. April/May, 2006] and in an update report: "Expansion and Excellence: A Report on the Red River Floodway" [*Commerce & Industry Magazine*. 58(7): 10-22. Fall 2007].

- ◆ As the demand for energy continues to grow, new channels for distribution need to be constructed. In "Not in Our Backyard!" [*Canadian Business*. 80(21):77-83. October 22, 2007. www.canadianbusiness.com]

Andrew Nikiforuk discusses controversies associated with the construction of a new 500-kilovolt transmission line from Edmonton to Calgary. Beginning in May 2004 the Alberta Electrical System Operator, a non-profit provincial agency that plans the electrical grid, submitted 13 different plans for a new power line between Calgary and Edmonton. The line was required to meet the rapidly increasing demand for electricity. The Energies Utility Board approved a routing in April 2005 and then notified affected landowners. Controversy erupted and a number of investigations were undertaken related to the approval process. A continuing story of interest as the demand for energy grows.

- ◆ In "The Need for Speed" [*Alberta Venture*. 12(1):115-118. January, 2008. www.albertaventure.com]. Anthony Davis discusses plans for constructing a high speed bullet train between Edmonton and Calgary. This new transportation link has been discussed for many years and with population

and business growth government is now looking favourably. A decision is expected in the near future. The continuing growth of energy related projects in the Prairie Provinces has been in the news, both for the need for increased energy and the environmental costs. In "Upgraderville" [*Alberta Venture*. 11(12):116-122. December, 2007]. Kelsey Strachan discusses the increasing transformation of our agricultural lands into industrial sites.

- ◆ Montréal's Air Transat is a global travel powerhouse, ranked as the worlds fifth-largest integrated travel company. The company is profiled in "Magic in the Air" [*Globe and Mail's: Report on Business*. 24(9): 38-45. March, 2008. www.globeandmail.com/robmagazine]. In other areas of Canadian aviation, Mike Minnich discusses the bright future for Canadian flying schools in "Ramping Up: Canadian Flight Schools Take on the Future". *Wings Magazine*. [49(1), 24-26, January/February, 2008. www.wingsmagazine.com]; three representative flights schools are profiled. In "Runway Model. [*BCBusiness*. 36(1): S12-S17. January, 2008. www.bcbusinessonline.ca], Helena Zukowski profiles an entrepreneur who heads one of Canada's most renowned kit-airplane manufacturers.
- ◆ *The Futurist* magazine (www.wfs.org) publishes articles and reports dealing with significant social and technological trends and informed forecasts about where they may lead as well as information on topics of interest to people seeking future success for their organizations and for themselves. Part one of their annual "Trends Shaping Tomorrow's World" series was published in the March-April, 2008 issue [42(2)] with part two being published in the May-June issue. Part one provides forecasts and their implications for business, government, and consumers. Topics include: General long-term economic and societal trends; values, concerns, and lifestyles; energy; and the environment. Continuing on the same topic issues that will likely define the business environment in 2008 are described in "The Watch List" [*Canadian Business*. 81(1):11-18, December 24, 2007 www.canadianbusiness.com] Topics discussed include interest rates, manufacturing, staffing, food costs, and other issues.

For author's biography, see page 29.

Active infrared thermography with applications

1.0 Introduction

Active infrared thermography [1] is a nondestructive testing and evaluation (NDT&E) technique requiring an external source of energy to induce a temperature difference between defective and non-defective areas in the specimen under examination. A wide variety of energy sources are available, the most common types can be divided into optical, mechanical or inductive, although many other sources can be employed. Figure 1 shows typical examples of heat sources of these three excitation types.

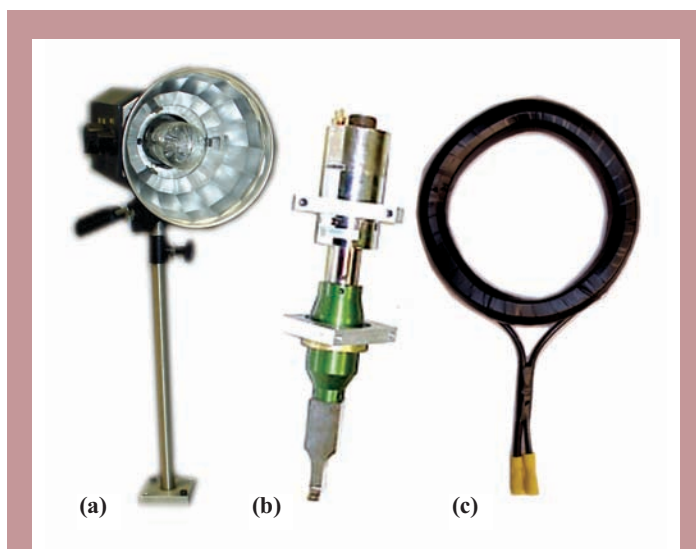


Figure 1. Heat sources examples: (a) optical: photographic flash, (b) mechanical: ultrasound generator, and (c) inductive: electromagnetic coil / Exemples de sources de chaleur : (a) optique : flashes photographiques, (b) mécanique : générateur d'ultrasons, et (c) inductive : bobine électromagnétique.

1.1. Optical Excitation

With optical excitation, defects are stimulated externally, that is, the energy is delivered to the surface of the specimen, where light is transformed into heat. Thermal waves propagate by conduction from the surface through the specimen until they reach an internal discontinuity that either slows down or speeds up their propagation (depending on the thermal properties of both the specimen and the discontinuity). This can be seen as hot or cold spots on the specimen's surface with an infrared camera. Optical devices include photographic flashes (for pulsed heat stimulation, see Figure 1a), infrared lamps (for step heating) or halogen lamps (for periodic heating), among others. This is the most widely used form of excitation in thermography for NDT&E [2]. It was originally used to develop the classical thermographic techniques, pulsed and lock-in thermography, described in section 2.

1.2. Mechanical Excitation

In the case of mechanical excitation, the energy is applied into the specimen by means of mechanical oscillations using, for example, a sonic or ultrasonic transducer that is in contact with the specimen (usually a coupling media is employed); see Figure 1b. In this case, the defects are stimulated internally; the mechanical oscillations transmitted into the specimen spread in all directions inside it. The mechanical energy is dissipated at the discontinuities in the form of heat waves that travel to the surface by conduction.

Ultrasonic excitation has received considerable attention in recent years. The technique known as vibrothermography (also ultrasound thermography [3] or thermosonics [4]), is typically used in the inspection of cracks and micro-cracks [5] in metallic structures, which are very difficult to

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Abstract

Infrared thermography is a nondestructive testing and evaluation (NDT&E) technique particularly interesting for the remote examination of large structures requiring a fast and safe inspection and without having to remove any component. These characteristics are very attractive to the automotive and aerospace industries, among others. Contrary to the passive approach, which does not require any additional stimulus to operate, the active approach needs an external source of energy to induce a thermal difference between the specimen and potential surface or subsurface defects. A summary of the different techniques and configurations is presented as well as two illustrative applications related to the aerospace industry.

Sommaire

La thermographie infrarouge est une technique d'essais non-destructifs (END) particulièrement intéressante pour l'inspection à distance de surfaces larges nécessitant une inspection rapide et sécuritaire et sans besoin de retirer des composantes. Ces caractéristiques sont très attirantes pour l'industrie automobile et l'aérospatiale, entre autres. Contrairement à l'approche passive, pour laquelle une stimulation thermique additionnelle n'est pas requise, l'approche active a besoin d'une source d'énergie externe pour induire une différence de température entre le spécimen et des éventuels défauts surfaciques ou sous-surfaciques. Un résumé des différentes techniques et configurations en thermographie active est présenté ainsi que deux exemples représentatifs de l'industrie aérospatiale.

inspect by optical means. As in optical excitation, pulsed thermography (better known as burst thermography in the case of ultrasonic excitation) and lock-in thermography are used.

1.3. Inductive Excitation

Inductive excitation can be applied internally to electro-conductive materials, generating eddy currents at a specific depth (determined by the frequency of the excitation), heating up the specimen and the eventual internal defects. Surface or subsurface defects produce variations on the eddy current patterns, changing the temperature distribution. As with the previous excitation forms, these temperature variations can be detected on the surface with an infrared camera.

Eddy current thermography [6] or Induction heating thermography [7] is the latest development in the field of active thermography. It is receiving considerable attention at the moment (year 2008) from researchers around the world [8]-[9]. As in the case of optical and mechanical excitation, inductive stimulation can be deployed in the form of pulses (pulsed thermography) or amplitude modulations (lock-in thermography), which are discussed in section 2.

1.4. Data Acquisition and Configurations

A typical data acquisition setup for active thermography is depicted in Figure 2. For simplicity, only optical excitation is portrayed in this illustration. Similar configurations are used for mechanical and inductive excitations. The experiments can be performed in reflection, that is, both

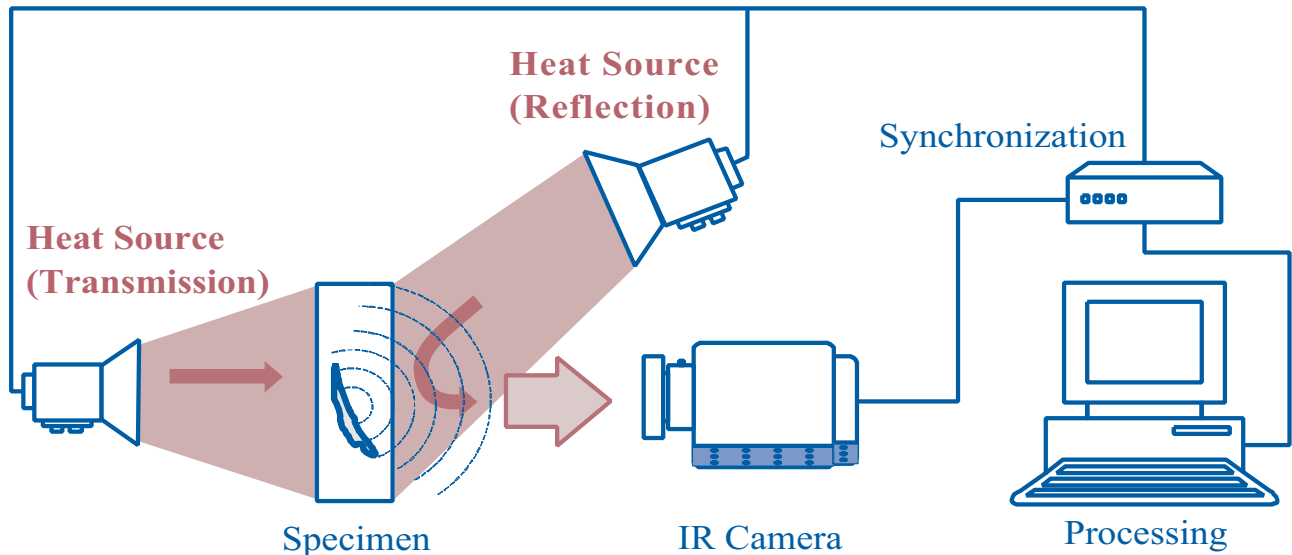


Figure 2. Experimental setup for active (optical) thermography inspection. / Configuration expérimentale pour l'inspection en thermographie active (optique).

the heating and the recording are performed from the same side, or in transmission, that is, the surface is heated from one side and data is acquired from the opposite side [2].

When using an external stimulation (as with optical excitation), the reflection approach is best suited to detect defects located close to the heated surface; the transmission approach allows detecting defect close to the rear surface because of the spreading effect of the thermal front. It should be noted, however, that it is not always possible to use the transmission approach since the rear surface is not always accessible. Similarly, in the case of complex structures made of various thicknesses of different materials, the defect depth cannot be estimated since the thermal waves travel the same distance regardless of the defect depth. In the case of internal stimulation (mechanical or inductive), the choice of one configuration over the other is a matter of finding the best location to position the heat source, which is often limited by accessibility.

2.0 Techniques

Regardless of the excitation mode being used, there are basically three thermographic techniques: pulsed, step and lock-in. The experimental and theoretical aspects are different for each of these techniques and so are the typical applications.

2.1. Pulsed Thermography

Pulsed thermography (PT) is one of the most popular thermal stimulation methods in active thermography [1]-[2]. One reason for this is the quickness of the inspection relying on a short thermal stimulation pulse, with duration going from a few milliseconds for high conductivity material inspection (such as metals) to a few seconds for low conductivity specimens (such as plastics). In addition, the brief heating prevents damage to the component.

Depending on the excitation source, it might be interesting to observe both the heating phase (while the pulse is applied) and the cooling phase, or only the surface cooling phase. For instance, in optical PT there is no interest in observing the thermal changes during the excitation since these images are often saturated. More importantly, this early data does not contain any information about the internal defects yet. However, images prior to the excitation (cold images) are very useful at pre-processing stages and for some advanced processing techniques. Conversely, thermal changes in vibrothermography are very fast – a few seconds – and important information can be found at any instant, during heating or cooling. In this case, the whole profile needs to be analyzed.

There are many processing techniques such as: thermal contrast, differential absolute contrast (DAC), principal component thermography (PCT), thermographic signal reconstruction (TSR), and pulsed phase thermography (PPT). References [10] to [13] describe all these techniques in detail.

2.2. Step Heating Thermography

Step heating uses a larger pulse (from several seconds to a few minutes). The temperature decay is of interest; in this case, the increase of surface temperature is monitored during the application of a step heating pulse. Variations of surface temperature with time are related to specimen features as in PT. This technique is sometimes referred to as time-resolved infrared radiometry (TRIR). TRIR finds many applications such as evaluation of coating thickness – including multilayered coatings, determination of coating-substrate bond integrity or evaluation of composite structures [14]. Although at the moment only optical excitation has been used in step heating, there is no limitation to the use of other excitation forms.

2.3. Lock-in Thermography

In lock-in thermography (LT) [15], also known as modulated thermography [16], the specimen is stimulated with a periodic energy source. Typically, sinusoidal waves are used, although it is possible to use other periodic waveforms. Internal defects, acting as barriers for heat propagation, produce changes in amplitude and phase delay of the response signal at the surface. Different techniques have been developed to extract the amplitude and phase information. Fourier analysis is the preferred processing technique since it provides single images, amplitudes or phasegrams (the weighted average of all the images in a sequence). The resulting Signal-to-Noise Ratio (SNR) is therefore very high. Phase data in particular is very interesting in NDT&E [17] as it is less affected than raw thermographic data by non-uniform heating, emissivity variations at the surface, reflections from the environment and surface geometry [18].

3.0 Experimental Results

3.1 Inspection of a Honeycomb Calibration Plate

The specimens used in this experiment consisted of an NDT&E standard aluminum honeycomb core sandwich panel with a multi-layer graphite epoxy face sheet (skin) shown in Figure 3a. The aluminum honeycomb

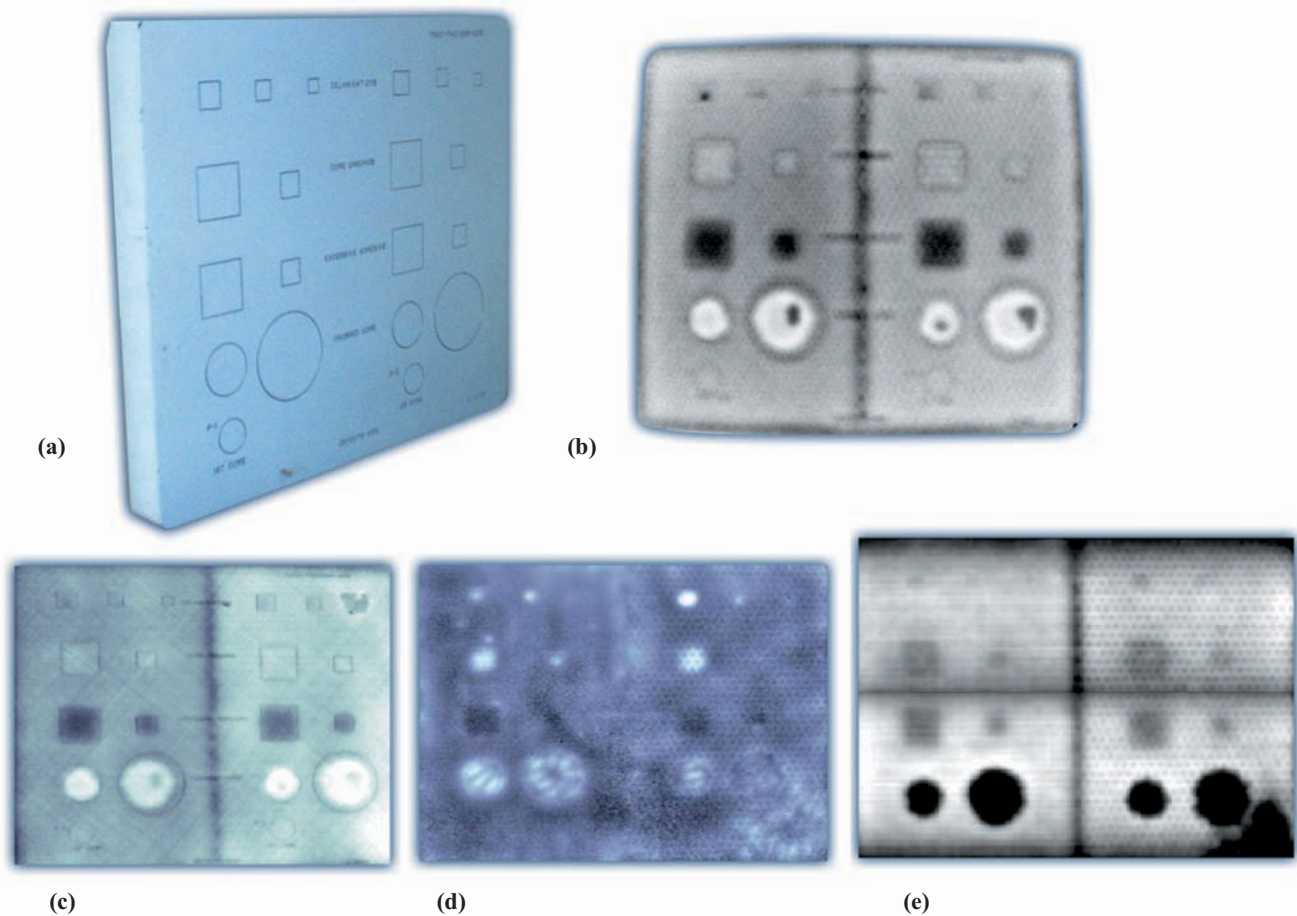


Figure 3. (a) Photo of the calibration plate, (b) first time derivative obtained by optical pulsed thermography, (c) phasegram at 0.04 Hz obtained by optical LT, (d) phasegram at 2 Hz obtained by lock-in VT, and (e) reconstructed thermogram obtained by line excitation eddy current thermography. / (a) Photo de la plaque de calibration, (b) première dérivée temporelle obtenue par thermographie pulsée optique, (c) phasegramme à 0.04 Hz obtenue par thermographie modulée optique, (d) phasegramme à 2 Hz obtenue par vibrothermographie modulée, (e) thermogramme reconstruit par thermographie de courants de Foucault (inspection en ligne).

core has two cell densities, and contains four types of fabricated defects: delaminations (simulated using Teflon® coated fabric), skin unbonds (fabricated using Teflon® coated fabric), excessive adhesive, and crushed core. This type of panel is commonly used in the aerospace industry for the calibration of NDT&E equipment.

Figure 3b shows the result obtained by optical pulsed thermography. Data was processed by thermographic signal reconstruction (TSR) [19]. The image shown corresponds to a first time derivative calculated from synthetic data. All defects are visible as well as the honeycomb core. A phasegram result obtained by optical lock-in thermography is presented in Figure 3c. All defects can be detected at this particular frequency as well as the carbon fibres (at a 45° orientation) and some surface features such as the inscriptions – and a painting scratch in the rightmost delamination defect which was not present when the specimen was inspected by optical pulsed thermography (Figure 3b).

Figure 3d presents a phasegram obtained by lock-in vibrothermography at a frequency of 2 Hz for 3 cycles. Most of the defects are visible. Some standing waves, i.e. wave patterns that do not correspond to defects or to the honeycomb core, can be seen in the crushed core defects but nowhere else for this particular modulation frequency. It is difficult to distinguish the honeycomb core on the left side, which has a higher density. The right side honeycomb core on the contrary can be seen in this image. The right lower corner of the plate was damaged during the preliminary tests. Hence, previous results from optical techniques (Figure 3b and Figure 3c) do not show any sign of the damage.

Finally, the panel was inspected by eddy current thermography; the

result can be seen in Figure 3e. No processing was applied to this result. It was reconstructed from a time sequence where the specimen was static but the camera and the heat source were in motion. All defects can be seen. Moreover, except for crushed core defects, there is practically no temperature difference between defect types. The core damage (resulting from preliminary tests) at the right corner can also be seen.

3.2 Inspection of Aircraft Rudders

CF18 aircrafts from the Canadian Air Forces (Figure 4a) as well as their American counterparts the F18 from the US Navy have been in service for more than 20 years. Over the lifetime of these aircrafts, some of the flight control surfaces – such as rudders and flaps – made of honeycomb sandwich structures might be subjected to water ingress or impact damage. This might lead to delamination and disbond of the facesheets (skin).

Figure 4b presents a F18 rudder, from which a section was cut off (Figure 4c). This specimen was subjected to impact damage at two locations and water ingress was simulated by filling several honeycomb cells with water. The two results shown in this figure correspond to optical pulsed thermography (Figure 4d) and optical lock-in thermography (Figure 4e). When inspecting the specimen by pulsed thermography, several honeycomb cells were completely filled with water (injecting the fluid from one side and inspecting the piece in reflection from the opposite side); they are perfectly visible in Figure 4d. The two impact damage sites can be seen as well. The optical lock-in result shows only the two impact damage defects since no water was used in this case.



Figure 4. Rudder section inspected by optical pulsed and lock-in thermography / Section du rudder inspecté par thermographie optique: pulsée et modulée.

4. Conclusions

The three main active thermography techniques can be used in the NDT assessment of industrial materials. Selection of the most suitable energy source depends on the application. Optical pulsed thermography is fast and easy to deploy. Although data are affected by different problems (non-uniform heating, emissivity variations, environmental reflections and surface geometry), there are numerous processing techniques available to counter these problems and therefore to obtain prompt results of reliable quality, as well as quantitative information in some instances. Optical lock-in thermography allows better control of the energy deposited on a surface, which might be interesting if a low power source is to be used or if special care has to be given to the inspected part – for inspection of artworks for example. However, it requires a separate experiment for each and every inspected depth and there is a stabilization time before reaching a permanent regime.

Vibrothermography is extremely fast in either lock-in or burst configuration, although it is necessary to relocate the transducer (and to immobilize the specimen again) to cover a large area for inspection, and very often optimal inspection parameters must be found experimentally. Hence, vibrothermography is more suitable for relatively small objects. On the other hand, there is only minimal heating of the inspected specimen since the energy is usually dissipated mostly at the defective areas (but there may be some localized heating at the coupling and clamping points).

Eddy current thermography is a very promising technique. Although it is limited to electro-conductive materials, the range of potential applications is extensive, from metal laminates such as GLARE, to composite materials and sandwiched structures such as the honeycomb specimens presented herein.

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Dr. Clemente Ibarra-Castanedo is a postdoctoral researcher in the Computer Vision and Systems Laboratory of Laval University in Quebec City, Canada. As a member of the multipolar infrared vision Canada Chair (MiViM), he has contributed in several publications in the field of infrared thermography. His research interests are in signal processing and image analysis for the nondestructive characterization of materials by active thermography.



Marc Genest joined the Non-Destructive Evaluation Group at the National Research Council Canada Institute for Aerospace Research in 2004 as a Research Associate. He has a Bachelor of Engineering and a Master of Science from the Université Laval. He is involved in research and development of thermography for non-destructive evaluation. He is also implicated in fields related to NDE such as data processing and health monitoring.



Marc Grenier is currently involved in a Ph. D. program at Laval University. His research interests are in induction thermography and eddy current for nondestructive testing. Marc has over 9 years of professional experience in the development of commercial eddy current and ultrasonic inspection system.



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Professor Xavier Maldague has been a professor at the Electrical and Computing Engineering Department of Laval University since 1989 and head of the Department since 2003. His research interests are in infrared thermography, NonDestructive Evaluation (NDE) techniques and vision and digital systems for industrial inspection. He authored or co-authored over two hundred papers, three books, and two patents on these topics. He is active in several international organizations working in infrared NDE. He is a member of CINDE, ASNT, IEEE and co-editor of the Can. Journal of Electrical and Computing Engineering. In 2004, he was awarded the Canadian Research Chair MiViM on Multipolar Infrared Vision. He is a world leader in infrared thermography and the holder of the MiViM Canada Research Chair.





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2008 IEEE Canada A.G.L. McNaughton Gold Medal

in recognition of outstanding contributions as a pioneer of the Canadian space program and a semiconductor circuit innovator

Médaille d'or A.G.L. McNaughton de l'IEEE Canada 2008

en reconnaissance des contributions exceptionnelles en tant que pionnier du programme spatial Canadien et comme innovateur en matière de circuits semi-conducteurs

Colin A. Franklin (LSMIEEE), M.Sc (Physics) Auckland University, New Zealand; Ph.D (Electrical Engineering) Imperial College, London, England; 1952 Physics lecturer, Auckland University; 1953-1959 Royal New Zealand Air Force, Scientific Defence Corps; 1957-1969 Defence Research Telecommunications Establishment (DRTE), Ottawa; 1969-1985 Department of Communications (DOC) Ottawa; 1986 Ministry of State for Science and Technology, Ottawa; 1987-1990 Visiting Professor, EE Dept, Auckland University; 1990-1992 Chief Scientist SPAR Aerospace, Montreal.

While Chief Electrical Engineer for Canada's first satellite, Alouette, it was named by the Engineering Centennial Board in 1987 as one of ten most outstanding achievements of Canadian engineering in past 100 years. In 1993 IEEE designated Alouette /ISIS program an International Milestone of Electrical Engineering. Subsequently he served as Chief Engineer at DRTE for the ISIS series of scientific satellites and as Project Manager for the DOC communications technology satellite Hermes. Launched in 1976 the satellite was the forerunner of the direct-to-home broadcast satellites. In 1976 he produced a DOC report on the European Space Agency (ESA) which led in 1978 to the signing of the Agreement for Cooperation between Canada and ESA.

Dr. Franklin has been honoured on many occasions; 1978 FRSC (Fellow of the Royal Society of Canada) in recognition of his contributions to the Canadian Scientific Satellite program, FCGI (Fellow of City & Guilds of London Institute) for advancements to science and technology, 1990 CM (Member of Order of Canada) for his role in the design and construction of Alouette, and for contributions to the Canadian Space Program, 1994 IEEE Pioneers Award on 50th Anniversary of Ottawa Section, 1996 Alouette Award from Canadian Aeronautics and Space Institute, 2002 John H. Chapman Award from the Canadian Space Agency - this award is the ultimate recognition of the individuals behind the Canadian Space Program - the award highlights an outstanding achievement, its socio-economic benefits and the recipient's merits.

Colin A. Franklin (LSMIEEE), M.Sc (Physique) Université d'Auckland, Nouvelle Zélande; Ph.D (Génie électrique), du "Imperial College" de Londres, Angleterre; 1952 chargé de cours en physique à l'Université d'Auckland; 1953-1959 Corps scientifiques de la Défense de l'armée de l'air royale de la Nouvelle Zélande; 1957-1969 Établissement de recherche de la défense sur les télécommunications (DRTE), à Ottawa; 1969-1985 Département des communications (DOC) à Ottawa; 1986 ministère d'état pour la Science et la technologie, à Ottawa; 1987-1990 Professeur invité, département de génie électrique, Université d'Auckland; 1990-1992 Chef Scientifique chez SPAR Aerospace à Montréal.

Alors qu'il était ingénieur électrique en chef pour le projet de premier satellite du Canada, Alouette, ce projet a été désigné par le conseil centenaire de génie en 1987 comme étant un des dix accomplissements les plus exceptionnels du génie canadien au cours des derniers 100 ans. En 1993, l'IEEE a désigné le programme Alouette/ISIS comme Jalon international du génie électrique. Par la suite, il a été ingénieur en chef chez DRTE pour la série ISIS de satellites scientifiques et chef de projet pour le satellite de communication Hermes du DOC. Lancé en 1976 le satellite était le précurseur des satellites d'émission directe vers la maison. En 1976, il a produit un rapport DOC sur l'Agence spatiale européenne (ESA) qui a mené en 1978 à la signature de l'accord pour la coopération entre le Canada et l'ESA.

Dr. Franklin a été honoré à plusieurs occasions; 1978 FRSC (Fellow de la Société Royale du Canada) en reconnaissance de ses contributions au programme de satellite scientifique Canadien, FCGI (Fellow of City & Guilds of London Institute) pour avancements au niveau de la science et de la technologie, 1990 (membre de l'ordre du Canada) pour son rôle dans la conception et la construction d'Alouette, et pour ses contributions au Programme spatial Canadien, 1994 Prix des pionniers de l'IEEE au cinquantième anniversaire de la section d'Ottawa, 1996 Prix Alouette de l'institut canadien de l'espace et de l'aéronautique, 2002 Prix John H. Chapman de l'agence spatiale Canadienne - ce prix constitue une reconnaissance ultime des individus derrière le programme spatial Canadien - ce prix met en évidence un accomplissement exceptionnel, ses avantages socio-économiques et les mérites des récipiendaires.



2008 IEEE Canada R.A. Fessenden Medal

for pioneering contributions to radar and wireless communications

Médaille R.A. Fessenden de l'IEEE Canada 2008

pour contributions en tant que pionnier dans les communications radar et sans fil

Simon Haykin (FIEEE) received his B.Sc (First Class Honours), Ph.D. and D.Sc, all in Electrical Engineering at the University of Birmingham in England. Presently he is a University Professor in the Department of Electrical and Computer Engineering at McMaster University, Canada. He is a Fellow of the IEEE and a Fellow of the Royal Society of Canada. He is the author/coauthor of 42 books, including the classic books: Adaptive Filter Theory (Prentice Hall), Neural Networks (Prentice Hall), and Communication Systems (Wiley), which are widely used around the world. He has published over 500 journal and conference papers.

Simon Haykin has made pioneering contributions to Adaptive Signal Processing, Radar, and Wireless Communications. For these pioneering contributions, he has been awarded the following honours and medals: Doctoral of Technical Sciences, ETH, Zurich, Switzerland; Henry Booker Gold Medal, URSI; McNaughton Gold Medal, IEEE Region 7; Ross Gold Medal, Engineering Institute of Canada, Canadian Telecommunications Gold Medal, Queen's University, Kingston, Canada. His current research interests are focused on Cognitive Dynamic Systems with particular emphasis on design of a new generation of adaptive hearing system for the hearing impaired (encompassing a cocktailpart processor and neurocompensator); Nonlinear filtering for state estimation; Cognitive radar networks involving the use of inexpensive radar sensors; Robust algorithms for transmit power control and spectrum management in cognitive radio; and adaptive MIMO-OFDM wireless communications.

Simply put, Simon Haykin has put not only McMaster University but also Canada on the world stage of adaptive/cognitive signal processing applied to radar and wireless communications.

Simon Haykin (FIEEE) a obtenu ses diplômes de B.Sc (avec les honneurs du 1er rang), de Ph.D. et de D.Sc. en génie électrique l'Université de Birmingham en Angleterre. Il est actuellement Professeur extraordinaire ("University Professor") au département de génie électrique et informatique l'Université McMaster, Canada. Il est Fellow de l'IEEE et de la Société Royale du Canada. Il est l'auteur/co-auteur de 42 livres, dont les grands classiques: Adaptive Filter Theory (Prentice Hall), Neural Networks (Prentice Hall), et Communication Systems (Wiley), qui sont largement utilisés dans le monde scientifique. Il a publié plus de 500 articles de journaux ou conférences.

Simon Haykin est un pionnier qui a contribué de façon très significative au traitement adaptatif des signaux, aux radars et aux communications sans fils. Pour ses contributions remarquables, il a reçu les honneurs et les médailles suivantes: doctorat en sciences techniques, ETH, Zurich, Suisse; la médaille d'or Henry Booker, URSI; la médaille d'or McNaughton de l'IEEE Région 7; la médaille Ross Gold, Engineering Institute of Canada, la médaille d'or des télécommunications canadiennes, Queen's University, Kingston, Canada. Ses intérêts en recherche portent sur les systèmes cognitifs dynamiques avec un accent particulier sur la conception d'une nouvelle génération de systèmes auditifs adaptatifs pour les mal-entendants (comprenant un processeur de l'effet "cocktail party" et un neuro-compensateur); filtrage non-linéaire pour l'estimation d'états, réseaux cognitifs de radars avec utilisation de capteurs radars peu coûteux; algorithmes robustes pour le contrôle de puissance d'émission et la gestion du spectre en radio cognitive; et communications sans fil adaptatives de type MIMO-OFDM.

En résumé, Simon Haykin a placé, non seulement l'Université McMaster, mais aussi le Canada, sur la scène internationale du traitement adaptatif/cognitif du signal appliqué au radar et aux communications sans fil.



2008 IEEE Canada Power Medal

for pioneering research and application of reliability concepts in electric power systems

Médaille d'électricité de l'IEEE Canada 2008

pour recherche et application innovatrices dans le domaine des concepts de fiabilité des systèmes électriques

Roy Billinton (LFIEEE) obtained B.Sc and M.Sc degrees from the University of Manitoba and Ph.D and D.Sc degrees from the University of Saskatchewan. He joined the University of Saskatchewan in 1964, after working in the System Planning and Production Division of Manitoba Hydro. He served the College of Engineering as the Head of the Electrical Engineering Department, Associate Dean (Graduate Studies, Research and Extension) and Acting Dean. He became an Emeritus Professor on July 1, 2003 and is actively engaged in research and graduate student supervision in the Electrical and Computer Engineering Department.

Dr. Billinton's area of research is power system reliability, economics and performance. He is the author/co-author of eight books and over 850 technical papers related to his research, with over 490 of these publications in refereed journals. He has made presentations, or given courses, in over thirty countries and has given over one hundred short courses on reliability evaluation to electric power utilities in Canada and abroad. One hundred and twenty graduate students have received M.Sc or Ph.D degrees under his supervision.

His research work is both national and international in scope and he received the CEA Centennial Award in 1991 for distinguished service to the Canadian electric power industry. He is a founding member of the CEA Consultative Committee on Outage Statistics and has served as its Chair for the last twenty years. He has been an active member of the IEEE since 1964 and has received the IEEE Outstanding Power Engineering Educator Award, the IEEE Canada McNaughton Gold Medal, and the IEEE Canada Outstanding Engineering Educator Award. He has been awarded the IEEE Charles Proteus Steinmetz Award for 2008. He is a Fellow of the RSC, CAE, IEEE, EIC, UK SRS, a Foreign Associate of the US NAE and a PEng in Saskatchewan.

Roy Billinton (LFIEEE) détient un B.Sc et une M.Sc de l'Université du Manitoba et un Ph.D et un D.Sc de l'Université de la Saskatchewan. Il a joint l'Université de la Saskatchewan en 1964, après avoir travaillé dans la division de planification et de production de Manitoba Hydro. Il a agi comme chef du département de génie électrique, comme doyen associé (études avancées et recherche) et comme doyen temporaire. Il est devenu un professeur émérite le 1^{er} juillet 2003, et il est activement engagé dans la recherche et la supervision d'étudiants diplômés au département de génie électrique et de génie informatique.

Le domaine de recherche du Dr. Billinton est la fiabilité et la performance des systèmes électriques. Il est auteur/co-auteur de huit livres et plus de 850 articles techniques liés à sa recherche, avec plus de 490 de ces publications dans des journaux avec comité de lecture. Il a fait des présentations, ou donné des cours, dans plus de trente pays et a donné plus de cent cours de courte durée sur l'évaluation de la fiabilité dans des compagnies productrices d'électricité au Canada et l'étranger. Cent vingt étudiants diplômés sous sa supervision se sont vus décerner une M.Sc ou un Ph.D.

Son travail de recherche est d'envergure nationale et internationale et il a reçu la récompense centenaire de la CEA en 1991 pour service distingué à l'industrie canadienne de production d'énergie électrique. Il est un membre fondateur du comité consultatif de la CEA sur les statistiques de panne et a agi comme président lors des vingt dernières années. Il a été membre actif de l'IEEE depuis 1964 et a reçu le Prix d'enseignement exceptionnel en génie électrique de l'IEEE, la médaille d'or McNaughton de l'IEEE Canada, et le prix d'excellence en enseignement du génie de l'IEEE Canada. Il a reçu le prix Charles Proteus Steinmetz de l'IEEE en 2008. Il est Fellow du RSC, CAE, IEEE, EIC, SRC du R-U, associé étranger du US NAE et possède le titre de PEng en Saskatchewan.



2008 IEEE Canada Computer Medal

for world-class leadership in computational intelligence and fuzzy systems

Médaille d'informatique de l'IEEE Canada 2008

pour leadership de niveau mondial en intelligence artificielle et systèmes de logique floue

Witold Pedrycz (FIEEE) is Professor and Canada Research Chair in the Department of Electrical & Computer Engineering, University of Alberta. Prior to joining University of Alberta in 1998 he was with the University of Manitoba as Associate Professor and then Professor and Associate Head (Computer Engineering). He is also with the Systems Research Institute of the Polish Academy of Sciences, Warsaw, Poland. Dr. Pedrycz holds PhD and DSci both from the Silesian University of Technology, Gliwice, Poland.

Dr. Pedrycz's research interests encompass Computational Intelligence, fuzzy modeling, knowledge discovery and data mining, fuzzy control including fuzzy controllers, pattern recognition, knowledge-based neural networks, granular and relational computing, and quantitative Software Engineering. He has published numerous and highly cited papers (ISI HighlyCited.comSM) in these areas and is also an author or co-author of 11 research monographs. The pioneering research accomplishments involve knowledge-based networks, collaborative fuzzy clustering and fundamentals of a new paradigm of Granular Computing. His research focused also on the advancements and applications of Granular Computing to the developments of human-centric systems.

Dr. Pedrycz has been actively engaged in a variety of professional activities of the IEEE. He served on numerous program committees of international conferences on Computational Intelligence (IEEE World Congresses on Computational Intelligence) and fuzzy systems (IEEE-FUZZ), delivered invited talks and tutorials including those under the auspices of the Distinguished Lecture Series. Currently he is an Editor-in-Chief of IEEE Transactions on Systems, Man, and Cybernetics – part A and serves as Associate Editor of IEEE Transactions on Fuzzy Systems. In October 2007 he was awarded a prestigious Norbert Wiener Award from the IEEE Systems, Man, and Cybernetics Society. Dr. Pedrycz is an Editor-in-Chief of Information Sciences. He is a senior Fellow of the Japan Society for Promotion of Science (JSPS).

Witold Pedrycz (FIEEE) est professeur et Directeur de Recherches Canada au département de génie électrique & informatique, de l'Université de l'Alberta. Avant de rejoindre l'Université de l'Alberta en 1998, il travaillait à l'Université du Manitoba comme professeur associé et puis comme professeur et directeur associé (génie informatique). Il travaille également avec l'Institut de recherche sur les systèmes de l'Académie Polonaise des Sciences, à Varsovie, en Pologne. Dr. Pedrycz possède un PhD et un Dsci, tous les deux de l'Université silésienne de technologie, Gliwice, Pologne.

Les intérêts de recherches du Dr. Pedrycz englobent l'intelligence artificielle (informatique), la modélisation floue la découverte de connaissance et l'exploitation de données, les contrôleurs en logique floue, la reconnaissance de forme, les réseaux neuronaux, le calcul granulaire et relationnel, et le génie de la programmation quantitative. Il a publié de nombreux articles très cités (ISI HighlyCited.comSM) dans ces domaines et est également auteur ou co-auteur de 11 monographies de recherches. Ses accomplissements innovateurs en recherches incluent les réseaux basé sur la connaissance, le groupement flou et les principes fondamentaux d'un nouveau paradigme en calcul granulaire. Sa recherche s'est concentrée également sur les avancements et les applications du calcul granulaire aux développements des systèmes humanocentriques.

Dr. Pedrycz a été activement engagé dans une variété d'activités professionnelles au sein de l'IEEE. Il a servi sur de nombreux comités de programme de conférences internationales sur l'intelligence artificielle (congrès mondial de l'IEEE sur l'intelligence artificielle) et les systèmes flous (IEEE-FUZZ), et il a donné des conférences en tant que conférencier distingué. Actuellement, il est Éditeur en chef des transactions de l'IEEE sur les systèmes flous, l'homme, et la cybernétique partie A, et il a été Éditeur associé des transactions de l'IEEE sur les systèmes flous. En octobre 2007 le prestigieux prix Norbert Wiener lui a été attribué par la société systèmes, Homme et cybernétique de l'IEEE. Dr. Pedrycz est Éditeur en chef de "Information Sciences". Il est Fellow Senior de la société Japonaise pour la promotion de la Science (JSPS).



2008 IEEE Canada Outstanding Engineer Award
for continuous outstanding contributions to the field of optical communications

Prix d'excellence en génie de l'IEEE Canada 2008
pour contributions continues exceptionnelles dans le domaine des communications optiques

Kim Roberts (MIEEE) is Director of Optics Research at Nortel. He holds a Bachelor degree in Electrical Engineering (honors mathematics), and a Masters degree in Electrical Engineering with a focus on signal processing for biomedical engineering. During his 23-year career with Nortel, Kim has emerged as the company's leading inventor in the optical field and one of its most prolific inventors, with 58 U.S. patents awarded and 35 additional patent filings.

Kim's significant contributions to optical communications include the development of Nortel's groundbreaking Multi-wavelength Optical Repeater (MOR) system, the industry's first bidirectional optical amplifier capable of supporting 8 wavelengths on a single fiber. Roberts' team designed the optical line to handle these wavelengths at both 2.5- and 10-Gbit/s rates, and he was the first to demonstrate integrated data packet encryption at 10-Gbit/s. Kim was instrumental in developing eDCO, a next-generation modem that uses electronic rather than optical technology to compensate for dispersion in optical networks, dynamically adjusts the modulation of individual wavelengths to overcome the inherent physical limitations of fiber, and enables fiber spans of 5,000 km without dispersion compensation. More recently, Roberts and the Nortel development team developed the first coherent 40-Gbit/s real-time transmission system that electronically compensates both chromatic and polarization mode dispersion, allowing ubiquitous 40-Gbit/s deployment. His current challenge is the design of a low-cost 100rGbit/s transmission system.

Kim routinely shares his expertise with the research and education community, and is in high demand as a speaker and committee member at IEEE and Optical Society of America (OSA) gatherings. In 2007, Kim was inducted as a Nortel Fellow, a lifetime honor bestowed on a few select individuals in Nortel's R&D community.

Kim Roberts (MIEEE) est Directeur de recherche Optique chez Nortel. Titulaire d'une licence (spécialité mathématiques) et d'une maîtrise (axée sur le traitement de signaux pour le génie biomédical) en génie électrique, Kim est devenu, en 23 ans de carrière chez Nortel, notre principal inventeur Optique et l'un des plus prolifiques, avec 58 brevets américains et 35 autres dépôts de brevets.

Kim a grandement contribué à l'essor des communications optiques, notamment grâce au système révolutionnaire MOR (Multiwavelength Optical Repeater), premier amplificateur optique bidirectionnel prenant en charge 8 longueurs d'onde sur une seule fibre. Kim, concepteur avec son équipe de la ligne optique permettant de traiter ces longueurs d'onde à des débits de 2,5 et de 10 Gbit/s, a démontré le premier le chiffrement de paquets de données à 10 Gbit/s. Il a joué un rôle majeur dans le développement d'eDCO, modem de nouvelle génération utilisant l'électronique plutôt que la technologie optique pour compenser la dispersion des réseaux optiques. Il permet d'adapter dynamiquement la modulation des longueurs d'onde pour dépasser les limites physiques des fibres et d'étendre leur portée à 5 000 km sans compensation de dispersion. Récemment, Kim et l'équipe de développement de Nortel ont conçu le premier système cohérent de transmission en temps réel à 40 Gbit/s compensant électroniquement la dispersion modale des couleurs et de polarisation, qui permet un déploiement universel à 40 Gbit/s. Son défi actuel : concevoir un système économique de transmission à 100 Gbit/s.

Kim, qui partage volontiers son expertise avec chercheurs et enseignants, est régulièrement amené à s'exprimer et à siéger dans des commissions pour l'IEEE et l'Optical Society of America (OSA). En 2007, Kim a été nommé Nortel Fellow, distinction honorifique qui récompense des parcours exceptionnels au sein de la communauté R&D de Nortel.



2008 IEEE Canada Outstanding Engineering Educator Award
for outstanding contributions to engineering education in Canada

Prix d'excellence en enseignement du génie de l'IEEE Canada 2008
pour contributions exceptionnelles à l'enseignement du génie au Canada

Andreas Antoniou (LFIEEE) Professor Emeritus, received his BSc and PhD degrees in Electrical Engineering from the University of London, UK, in 1963 and 1966, respectively. He taught at Concordia University during 1970-1983 and at the University of Victoria from 1983.

He served as Chair of the Department of Electrical and Computer Engineering at Concordia University during 1977-1983 and in this capacity he presided over the establishment of the second undergraduate computer engineering program in Canada. At the University of Victoria, he served as the founding Chair of the Department of Electrical and Computer Engineering which has grown to a medium-size, research-oriented, modern department with 29 regular and 5 emeritus faculty, 9 of whom are IEEE Fellows, and about 400 undergraduate and 130 graduate students. He is the author of *Digital Filters: Analysis, Design, and Applications* (McGraw-Hill, 1st ed. 1979, 2nd ed. 1993) and *Digital Signal Processing: Signals, Systems, and Filters* (McGraw-Hill, 2005), and the co-author (with Wu-Sheng Lu) of *Two-Dimensional Digital Filters* (Marcel Dekker, 1992) and *Practical Optimization: Algorithms and Engineering Applications* (Springer, 2007). He served as Distinguished Lecturer of the IEEE SP and CAS Societies during 2003-2004 and 2006-2007, respectively. He has carried out research in the areas of circuits and systems and digital signal processing, supervised many master's and doctoral students, and published extensively.

He is a member of the Association of Professional Engineers and Geoscientists of BC and a Fellow of the Institution of Engineering and Technology, London, UK. He received the Ambrose Fleming Premium for 1964 from the IET (best paper award), the CAS Golden Jubilee Medal from the IEEE CAS Society, the BC Science Council Chairman's Award for Career Achievement for 2000, an honorary doctoral degree from the National Technical University of Athens, Greece, in 2002, and the IEEE CAS Society 2005 Technical Achievement Award.

Andreas Antoniou (LFIEEE) Professeur Emeritus, a obtenu un BSc et un PhD en génie électrique de l'Université de Londres, R-U, en 1963 et 1966, respectivement. Il a enseigné à l'Université Concordia pendant la période 1970-1983 et à l'Université de Victoria à partir de 1983.

Il a occupé la position de directeur du département du génie électrique et génie informatique à l'Université Concordia pendant la période 1977-1983 et il a présidé l'établissement du deuxième programme de premier cycle en génie informatique au Canada. À l'Université de Victoria, il a été le directeur fondateur du département de génie électrique et génie informatique qui s'est développé en tant que département moderne orienté vers la recherche, avec un corps enseignant de 29 professeurs réguliers et 5 honoraires, dont 9 sont des Fellows de l'IEEE, et qui compte environ 400 étudiants de premier cycle et 130 de cycles supérieurs. Il est l'auteur des ouvrages *Digital Filters: Analysis, Design, and Applications* (McGraw-Hill, 1st ed. 1979, 2nd ed. 1993) et *Digital Signal Processing: Signals, Systems, and Filters* (McGraw-Hill, 2005), et il est le co-auteur (avec Wu-Sheng Lu) de l'ouvrage *Two-Dimensional Digital Filters* (Marcel Dekker, 1992) et *Practical Optimization: Algorithms and Engineering Applications* (Springer, 2007). Il a agit comme conférencier distingué pour les sociétés SP et CAS de l'IEEE pendant les périodes 2003-2004 et 2006-2007, respectivement. Il a effectué de la recherche dans les domaines des circuits et systèmes et du traitement numérique de signal. Il a dirigé beaucoup d'étudiants à la maîtrise et au doctorat, et publié intensivement.

Il est membre de "Association of Professional Engineers and Geoscientists" de la C.-B. et Fellow de "Institution of Engineering and Technology" de Londres au R-U. Il a reçu le Prix Ambrose Fleming de l'IET en 1964 (la récompense pour le meilleur article), la médaille d'or du jubilé de la société CAS de l'IEEE, le prix du Président du Conseil Scientifique de la C.-B. pour accomplissement de carrière en 2000, un doctorat honorifique de l'Université technique nationale d'Athènes, en Grèce, en 2002, et le prix d'accomplissement technique de la société CAS de l'IEEE en 2005.



2008 IEEE Canada W.S. Read Outstanding Service Award

in recognition of outstanding and sustained service to the profession & IEEE

Prix d'excellence de service W.S. Read de l'IEEE Canada 2008

en reconnaissance d'un service exceptionnel et soutenu à la profession et à l'IEEE

Bruno Di Stefano (SMIEEE) P.Eng., is president of Nuptek Systems Ltd, an engineering company (1981-present). Previously, he was senior design engineer for AES Data Ltd. and Delphax Systems. Bruno Di Stefano holds a "Dottore in Ingegneria Elettronica" degree, a 5 year university degree in Electronic Engineering followed by an advanced research thesis. Besides practicing engineering, Bruno has taught part time at Ryerson University (1985-1987), in the Professional Development Program of the Faculty of Applied Science and Engineering at the University of Toronto (1986-2003), and delivered many courses for many institutions and many in-house courses for various corporations.

Bruno has served the profession & society, in Canada & abroad, by working as a practitioner, an educator, an entrepreneur, and a volunteer with IEEE & PEO. His volunteering absorbs nearly 100% of his energy available outside his work and his family. He wears his "IEEE uniform" full time and is an inspiring role model for young engineers. He advertises IEEE and advocates for IEEE at every opportunity. Besides 14 refereed and 16 non-refereed scientific and technical publications, Bruno has written several articles at the boundary between professionalism, professional advocacy, and volunteer activities.

Bruno, IEEE member since 1979, has worked in the Toronto Section, the Central Canada Council/Area, the IEEE Canada Executive, many conferences, and the Computational Intelligence Society. A PEO member since 1980, he served in the executive of the Toronto-Dufferin Chapter (since 1992), in the "Professional Practice Committee", and as Chair of the "Engineering Disciplines Task Group". He has received the following IEEE awards: a Toronto Section Scholarship named in his honour (2003) (one of three in the 105 years of the Section history); IEEE Third Millennium Medal (2000); IEEE Central Canada Award (1998). Bruno is a Fellow of the Engineering Institute of Canada (2007).

Bruno Di Stefano (SMIEEE) P.Eng., est président de Nuptek Systems Ltd, une compagnie d'ingénierie (1981-aujourd'hui). Avant, il était ingénieur concepteur senior pour les compagnies AES Data Ltd. et Delphax Systems. Bruno Di Stefano détient un diplôme "Dottore in Ingegneria Elettronica", un diplôme universitaire de 5 années en génie électronique suivi d'une thèse de recherche avancée. Eplus de la pratique du génie, Bruno a enseigné à temps partiel à l'Université Ryerson (1985-1987), dans le cadre du programme de développement professionnel de la faculté de Science appliquée et de génie de l'université de Toronto (1986-2003), et a donné beaucoup de cours dans plusieurs établissements ainsi que de nombreux cours pour différentes sociétés.

Bruno a été au service de la profession et de la société, au Canada et à l'étranger, en travaillant en tant que praticien, éducateur, entrepreneur, et volontaire avec l'IEEE et la PEO. Son volontariat absorbe presque 100% de son énergie disponible en dehors de son travail et de sa famille. Il porte son "uniforme IEEE" à plein temps et est un modèle d'inspiration pour les jeunes ingénieurs. Il fait la promotion de l'IEEE et plaide en faveur de l'IEEE à chaque occasion. Il est à l'origine de près de 14 publications scientifiques et techniques avec comité de lecture et 16 publications sans comité de lecture. Bruno a écrit plusieurs articles concernant la frontière entre le professionnalisme, l'implication professionnelle, et les activités de volontariat.

Bruno, membre de l'IEEE depuis 1979, a travaillé pour la section de Toronto, la région du centre du Canada, l'exécutif IEEE Canada, beaucoup de conférences, et pour la "Computational Intelligence Society". Membre de la PEO depuis 1980, il a servi comme directeur du chapitre de Toronto-Dufferin (depuis 1992), au sein "du Comité de pratique professionnelle", et comme président du "Engineering Disciplines Task Group". Il a reçu les récompenses suivantes de l'IEEE : une bourse de la section de Toronto nommée en son honneur (2003) (l'une de trois en l'honneur des 105 années d'histoire de la section) ; la médaille millénaire de l'IEEE (2000) ; le prix du Conseil central du Canada de l'IEEE Canada (1998). Bruno est Fellow de l'institut de génie du Canada (2007).



2008 IEEE Canada J.J. Archambault Eastern Canada Merit Award
for the conception, design, and operation of the webinar program of IEEE Canada

Prix de mérite J.J. Archambault de l'est du Canada de l'IEEE Canada 2008
pour la conception, la mise en place, et l'opération du programme webinaire de IEEE Canada

Saman M. I. Adham (SMIEEE) received his B.Sc., M.Sc. (Eng) degrees from the University of Baghdad, Iraq in 1977 and 1979 respectively. From 1980 to 1985 he was a lecturer at the department of Electrical Engineering, University of Technology, Iraq. He joined the department of Electrical Engineering at Queens University, Kingston, Ontario in September 1985. After obtaining the Ph.D. degree he joined the Design For Testability (DFT) group at Bell Northern Research (BNR) in 1991 developing advanced DFT techniques and Build-In Self Test (BIST) for DSP and Telecom systems. He served as DFT Advisor at Nortel Networks (1995-1999) focusing on testability of telecommunication systems and establishing collaborative research programs with several Canadian universities on future Silicon Technologies. In August 1999 he joined LogicVision Inc., Ottawa, Canada where he is now a Senior Director of Engineering.

His IEEE activity include many years with the Ottawa Section at different levels including Section Treasurer 1994-1997, Vice Chair 1997-1998, Chair 1998-2000, Awards Committee Chair 2003-2005. At the national level he was the IEEE Canada Ethics Committee Chair 2003-2004, Eastern Area Chair 2006 and Educational Activities Chair 2007-2008. In his recent appointment he established the Web-based Seminar (Webinar) as a tool to deliver educational material to IEEE members. He successfully ran three webinars in 2007 on leadership development and project management. On the international technical side of IEEE Dr. Adham was the Vice Chair, North America Region, Test Technology Technical Council, 2004. He has also established and currently chairs the IEEE 1450.6.2 standard working group to standardize the test view of semiconductor memories.

His research interests are design for testability and built in self test of system on chip (SOC), fault modeling and diagnosis, electronic design automation and memory test algorithms. He has published over 20 papers and holds 4 patents in his research area.

Saman M. I. Adham (SM IEEE) a obtenu un B.Sc. et M.Sc. (Gén.) de l'Université du Baghdad en Iraq en 1977 et 1979. En septembre 1985, il est entré au département de génie électrique de l'Université Queens à Kingston (Ontario). Après avoir complété son doctorat (Ph.D.) en 1991, il est entré à l'emploi de Recherches Bell-Northern (BNR) où il a oeuvré dans le groupe de testabilisation (DFT) au développement de techniques avancées de testabilisation et de tests intégrés (BIST) pour les processeurs de signaux numériques (DSP) et les systèmes de télécommunications. De 1995 à 1999, il a occupé un poste de conseiller technique à Nortel Networks dans le domaine de la testabilité des systèmes de télécommunications. Durant cette période, il a mis en oeuvre des programmes de recherche en collaboration avec plusieurs universités canadiennes ayant pour objet le développement des prochaines générations de technologies de puces au silicium. Il est à l'emploi de LogicVision Inc à Ottawa depuis le mois d'août 1999 où il occupe présentement le poste de directeur principal de l'ingénierie.

En tant que membre de la section d'Ottawa de l'IEEE, il a occupé plusieurs postes: trésorier de 1994 à 1997, vice-président en 1997 et 1998 et, enfin, président du comité des récompenses de 2003 à 2005. Toujours pour l'IEEE mais cette fois au niveau national, il a été président du comité d'éthique en 2003 et 2004, président de la zone de l'est du Canada en 2006 et, finalement, président des activités éducationnelles depuis 2007. À ce titre, il a développé un programme de séminaires accessibles sur le Web (Webinaire) pour les membres de l'IEEE. Il a même animé trois séminaires de ce type en 2007 ayant pour objet la formation au développement du leadership et la gestion de projets. Au point de vue technique, le Dr. Adham a occupé le poste de vice-président du conseil technique des technologie de test de l'IEEE pour la région de l'Amérique du Nord. Enfin, il a créé et il préside actuellement le comité 1450.6.2 de l'IEEE dont le mandat est de standardiser le test des mémoires à semi-conducteurs.

Ses domaines de recherche de prédilection sont la testabilisation, le test intégré des systèmes sur une puce, la modélisation et l'identification des défauts de fabrication, les outils de conception électroniques et les algorithmes de test des mémoires. Il a publié plus de 20 articles scientifiques et il est titulaire de 4 brevets.



2008 IEEE Canada M.B. Broughton Central Canada Merit Award
for outstanding dedication and service to IEEE Canada and student activities

Prix de mérite M.B. Broughton du centre du Canada de l'IEEE Canada 2008
pour dévouement exceptionnel et service à IEEE Canada et aux activités étudiantes

Janet Bradley (MIEEE) is a graduate from the Electronics Engineering Technologist - Microelectronics Program at Niagara College of Applied Arts and Technology. In 2007, following an eleven year career with Gennum Corporation, Janet chose to pursue her long time interests in business and finance and began a new career as a financial consultant representing Investors Group. In keeping with her desire to work closer to her Niagara roots, Janet regularly assists as a partial-load professor for the Niagara College Technology Division.

Janet is a member of The IEEE Canadian Foundation board of directors and has been an active volunteer member of IEEE for 13 years. From 2005 to 2007 Janet served as the Region's Student Activities Committee Chairperson. Among her many accomplishments in this role, Janet had the privilege to coordinate the first three IEEE Canada Telus Student Innovation Awards competitions and the first Student Ethics Competition. Janet remains dedicated to IEEE student membership development, including our young future IEEE members, by initiating and participating in many college and pre-college awareness programs. Janet also enjoys promoting the important roles of Women In Engineering by accepting opportunities to speak at college and pre-college events across Southern Ontario. Janet is Past Chair of Hamilton Section and has also participated as Student Activities Chair for CCECE 2001 and 2004. Her current IEEE Role is as a member of the 2008 IEEE Ethics and Member Conduct Committee.

Janet's hard work and dedication has been recognized over the years. She received the Ontario Hydro Student Achievement Award of Honour, the IEEE McNaughton Scholarship, the OACETT Outstanding Technical Achievement Award and was nominated in 2000 for an Ontario Premier's Award for Technology.

Janet Bradley (MIEEE) possède un diplôme en "Electronics Engineering Technologist – Microelectronics" du "Niagara College of Applied Arts and Technology". En 2007, suite à une carrière d'onze années avec Gennum Corporation, Janet a choisi de porter ses intérêts à long terme dans les affaires et la finance et a débuté une nouvelle carrière comme conseillère financière représentant le groupe Investors. Tout en comblant son désir de travailler plus près de ses racines du Niagara, Janet agit régulièrement en tant que professeur à charge partielle à la division de technologie de l'Université du Niagara.

Janet est membre du conseil d'administration de la Fondation Canadienne de l'IEEE et a été membre volontaire actif de l'IEEE pendant 13 années. De 2005 à 2007 Janet a été présidente du Comité des activités étudiantes de la région. Parmi ses nombreux accomplissements dans ce rôle, Janet a eu le privilège de coordonner les trois premiers concours du prix d'innovation étudiante Telus de l'IEEE Canada et la première compétition d'éthique étudiante. Janet se consacre toujours au recrutement étudiant de l'IEEE, incluant nos jeunes futurs membres de l'IEEE, en lançant et en participant à beaucoup de programmes de sensibilisation universitaires et pré-universitaires. Janet a eu aussi le plaisir de faire la promotion des rôles importants des femmes en génie en acceptant de prendre la parole lors d'événements universitaires et pré-universitaires à travers la région du sud de l'Ontario. Janet est présidente sortante de la section d'Hamilton et a également participé comme présidente des activités étudiantes pour les CCGÉI 2001 et 2004. Elle est présentement membre du comités de conduite et d'éthique de l'IEEE pour 2008.

Le travail acharné et le dévouement de Janet ont été remarquables et reconnus au cours des années. Elle a reçu la récompense "Ontario Hydro Student Achievement Award of Honour", la bourse McNaughton de l'IEEE, la récompense "OACETT Outstanding Technical Achievement Award" et a été nommée en 2000 pour le prix en technologie du Premier Ministre de l'Ontario.



2008 IEEE Canada E.F. Glass Western Canada Merit Award
for promotion of IEEE Canada student activities and the establishment of student awards

Prix de mérite E.F. Glass de l'ouest du Canada de l'IEEE Canada 2008
pour la promotion des activités étudiantes de IEEE Canada et l'établissement des prix étudiants

David Gregson (SMIEEE) is a graduate of the University of Victoria with a Masters of Applied Science Degree. His recent professional activities include lead roles in the design and production of numerous monitoring and diagnostic systems for rail transit vehicles. Prior to becoming involved in rail transit systems he was involved in embedded hardware and software design with a focus on data acquisition and data telemetry systems in aeronautical, marine and industrial environments. He is also active within the University of Victoria community serving on various committees and occasionally as a sessional lecturer.

David has been a member of IEEE for over 25 years. He has served in various positions within the Victoria Section of the IEEE and is currently section chair. He was treasurer of the committee that established the IEEE PacRim Conference in Victoria in 1987 and the CSECE in Vancouver in 1988. The Victoria Section of the IEEE, in partnership with the University of Victoria, holds the PacRim conference biannually.

Over the years, David he has been involved in the organization of numerous workshops and other technical activities with the Victoria Section. He was directly involved in establishing a student awards night held twice at year at the University of Victoria. David was also instrumental in the establishment of three scholarships, one in each of Electrical, Computer and Software Engineering, at the University of Victoria in 2007. These scholarships were endowed using accumulated surplus funds from past IEEE PacRim Conferences and are called the *IEEE Pacific Rim Conference, Vijay Bhargava Scholarships*. David is also involved in IEEE at the international level. He is currently secretary of the Rail Transit Vehicle Interface Standards Committee and has been involved in the development of a series of IEEE standards for the rail transit industry including lead author of one standard.

David Gregson (SMIEEE) détient un diplôme de maîtrise en Science appliquée de l'Université de Victoria. Ses activités professionnelles récentes incluent des rôles majeurs en matière de conception et production de nombreux systèmes de surveillance et diagnostique pour les véhicules sur rail en transit. Avant de devenir impliqué dans les systèmes de transport sur rail il a été impliqué dans la conception de système informatique intégré et de logiciel se concentrant sur des systèmes d'acquisition de données et de télémétrie de données dans les environnements aéronautiques, marins et industriels. Il est également actif au sein de la communauté de l'Université Victoria en siégeant sur divers comités et donnant des charges de cours à l'occasion.

David a été membre de l'IEEE pendant plus de 25 années. Il a occupé diverses positions dans la section de Victoria de l'IEEE et est actuellement président de cette section. Il était trésorier au sein du comité qui a établi la conférence IEEE PacRim à Victoria en 1987 et le CSECE à Vancouver en 1988. La section de Victoria de l'IEEE, en association avec l'Université de Victoria, tient la conférence PacRim de façon biannuelle.

Au cours des années, David a été impliqué dans l'organisation de nombreux ateliers et autres activités techniques de la section de Victoria. Il a été directement impliqué dans l'établissement d'une soirée de récompenses étudiantes qui se tient deux fois par année à l'Université de Victoria. David a été également impliqué dans l'établissement de trois bourses à l'Université de Victoria en 2007, une pour chacun des domaines suivants : génie électrique, génie informatique et génie du logiciel. Ces bourses ont été constituées en utilisant les fonds de surplus accumulés des conférences PacRim de l'IEEE passées et ont été nommées bourses Vijay Bhargava de la conférence PacRim de l'IEEE. David est également impliqué dans l'IEEE au niveau international. Il est actuellement secrétaire du Comité de normes d'interface de véhicule de transit sur rail et a été impliqué dans le développement d'une série de normes de l'IEEE pour l'industrie du transit sur rail dont il est l'auteur principal d'une norme.

IEEE Canada members elected as 2008 EIC Fellows and Medalists by the EIC Board of Directors.

EIC Fellows

Dr. Gregor Bochman (FIEEE) - University of Ottawa
for exemplary leadership in promoting research collaboration between universities and industry

Dr. Mohamed Elmasry (FIEEE) - University of Waterloo
for contributions to the development of digital semiconductor devices and the design of integrated circuits

Dr. Alberto Leon-Garcia (FIEEE) - University of Toronto
for outstanding fundamental and applied research, university education and the training of industry professionals

Dr. Safa Kasap (SMIEEE) - University of Saskatchewan
for enormous advances in the development and commercialization of direct conversion x-ray image detectors for medical imaging

Dr. Raafat Mansour (FIEEE) - University of Waterloo
for pioneering in employing emerging materials and technologies such as high temperature superconductor and micro-electro-mechanical systems to build novel radio frequency devices with unprecedented performance

Dr. Witold Pedrycz (FIEEE) - University of Alberta
for world-class leadership with pioneering and highly acclaimed and influential contributions to the area of computational intelligence, granular computing, intelligent systems, fuzzy modeling, pattern recognition, quantitative software engineering, and data mining

Dr. Mohamed Sawan (FIEEE) - Ecole Polytechnique
for research in microcircuits and microsystems oriented toward biomedical applications

Dr. Paresh Sen (FIEEE) - Queen's University
for contributions to the evolution of improved industrial products

Dr. Gregory Stone (FIEEE) - Iris Power L.P.
for development of unique test methods for evaluating the expected life of stator winding insulation systems

Dr. Bin Wu (FIEEE) - Ryerson University
for exceptional contributions to the advancement of power electronics and adjustable-speed drive technologies

EIC Medalists

Dr. David Irvine - Halliday (MIEEE) - University of Calgary who received the K.Y. Lo Medal recognizing "Significant Engineering Contributions at the International Level" for his "Light Up The World" project to bring efficient lighting to the developing world.

Dr. Colin Franklin (LSMIEEE) retired from Canada's Space Program, who received the Julian C. Smith Medal which recognizes "Achievement in the Development of Canada" for his leadership as Chief Electrical Engineer for Canada's first satellite - Alouette and the subsequent ISIS.

EIC Honorary Member

Michael Lazaridis — co-CEO of Research in Motion

Membres de l'IEEE Canada élus Fellows ICI 2008 par le Conseil des Directeurs.

EIC Fellows

Dr. Gregor Bochman (FIEEE) - Université d'Ottawa
pour leadership exemplaire dans la promotion de la collaboration au niveau de la recherche entre les universités et l'industrie

Dr. Mohamed Elmasry (FIEEE) - Université de Waterloo
pour contributions au développement de dispositifs semi-conducteurs numériques et à la conception de circuits intégrés

Dr. Alberto Leon-Garcia (FIEEE) - Université de Toronto
pour activités de recherche fondamentale et appliquée exceptionnelles, éducation universitaire et formation de professionnels de l'industrie

Dr. Safa Kasap (SMIEEE) - Université de la Saskatchewan
pour avancements importants au niveau du développement et de la commercialisation de détecteurs d'image à partir de conversion directe de rayon X pour l'imagerie médicale

Dr. Raafat Mansour (FIEEE) - Université de Waterloo
pour avoir agité comme pionnier dans l'emploi de matériaux et technologies émergents tels le semi-conducteur à haute température et les systèmes micro-électro-mécaniques afin de construire des dispositifs RF nouveaux de performance sans précédent

Dr. Witold Pedrycz (FIEEE) - Université de l'Alberta
pour leadership d'envergure mondiale en matière de contributions innovatrices hautement acclamées qui ont influencées le domaine de l'intelligence artificielle, le calcul granulaire, les systèmes intelligents, la modélisation floue, la reconnaissance de forme, le génie de la programmation quantitative et l'exploitation de données

Dr. Mohamed Sawan (FIEEE) - Ecole Polytechnique
pour recherche sur les microcircuits et les microsystèmes orientés surtout vers les applications biomédicales

Dr. Paresh Sen (FIEEE) - Université Queen
pour contributions à l'évolution des produits industriels améliorés

Dr. Gregory Stone (FIEEE) - Iris Power L.P.
pour le développement des méthodes d'essai unique permettant d'évaluer la vie utile attendue des systèmes d'isolation de bobinage de stator

Dr. Bin Wu (FIEEE) - Université Ryerson
pour contributions exceptionnelles à l'avancement de l'électronique de puissance et des technologies de commande à vitesse variable

EIC Medalists

Dr. David Irvine-Halliday (MIEEE) - Université de Calgary qui recevait la médaille K.Y. Lo en reconnaissance de "contributions significatives de niveau international en matière de génie" pour son projet "Light Up The World" qui amena un éclairage efficient au monde en développement

Dr. Colin Franklin (LSMIEEE) retraité du Programme Spatial Canadien, qui recevait la médaille Julian C. Smith reconnaissant "l'Accomplissement au niveau du développement du Canada" pour son leadership comme ingénieur électrique en chef du premier satellite canadien - Alouette et ISIS par la suite

EIC Honorary Member

Michael Lazaridis — co-CEO de Research in Motion

IEEE Canada members elected as 2008 IEEE Fellows by the IEEE Board of Directors.

Kenneth Cadien, FIEEE, Edmonton, Alberta
for contributions to chemical mechanical polishing

Timothy Driscoll, FIEEE, Calgary, Alberta
for leadership in the development of codes and standards for electrical safety in industry

Ling Guan, FIEEE, Toronto, Ontario
for contributions to image and multimedia signal processing

Vincent Hayward, FIEEE, Montréal, Québec
for contributions to robot manipulator programming and the development of haptic interface technology

Shesha Jayaram, FIEEE, Waterloo, Ontario
for contributions to the use of high voltage in process technology

Bogdan Kasztenny, FIEEE, Markham, Ontario
for contributions to protective relaying methods, designs, and applications

Jorg Liebeherr, FIEEE, Toronto, Ontario
for contributions to the design and analysis of computer networks and their protocols

Yvon Savaria, FIEEE, Montréal, Québec
for contributions to the development of long interconnect VLSI signal processing architectures

Ivan Stojmenovic, FIEEE, Ottawa, Ontario
for contributions to data communication algorithms and protocols for wireless sensor and ad hoc networks

Bin Wu, FIEEE, Toronto, Ontario
for contributions to high power converter technology and adjustable speed drives

En-hui Yang, FIEEE, Waterloo, Ontario
for contributions to source coding

Weihua Zhuang, FIEEE, Waterloo, Ontario
for contributions to mobile communications and networks

Membres de l'IEEE Canada élus Fellows IEEE 2008 par le Conseil des Directeurs.

Kenneth Cadien, FIEEE, Edmonton, Alberta
pour contributions au polissage mécanique chimique

Timothy Driscoll, FIEEE, Calgary, Alberta
pour son leadership dans le développement de codes et standards en sécurité électrique dans l'industrie

Ling Guan, FIEEE, Toronto, Ontario
pour contributions au traitement de l'image et de signal multimédia

Vincent Hayward, FIEEE, Montréal, Québec
pour contributions à la programmation de manipulateur robot et au développement de la technologie d'interface haptique

Shesha Jayaram, FIEEE, Waterloo, Ontario
pour contributions à l'utilisation de la haute tension dans la technologie de procédés

Bogdan Kasztenny, FIEEE, Markham, Ontario
pour contributions aux méthodes de protection par relais, aux conceptions et applications

Jorg Liebeherr, FIEEE, Toronto, Ontario
pour contributions à la conception et à l'analyse des réseaux informatiques et leurs protocoles

Yvon Savaria, FIEEE, Montréal, Québec
pour contributions au développement des architectures de traitement de signal VLSI à longue interconnexion

Ivan Stojmenovic, FIEEE, Ottawa, Ontario
pour contributions aux algorithmes de communication de données et protocoles de senseur sans fil et réseaux ad hoc

Bin Wu, FIEEE, Toronto, Ontario
pour contributions à la technologie de convertisseur haute - puissance et commandes à vitesse ajustable

En-hui Yang, FIEEE, Waterloo, Ontario
pour contributions au codage source

Weihua Zhuang, FIEEE, Waterloo, Ontario
pour contributions aux communications mobiles et réseaux



CCGEI 2009

22^{ème} Conférence Canadienne de Génie Électrique et Informatique

3-6 Mai 2009, St. John's, Terre-Neuve & Labrador, Canada

<http://www.ccece09.org>

“Des électrons aux océans : Innovation à grand échelle”

Appel préliminaire de communications et propositions

La Conférence Canadienne de Génie Électrique et Informatique édition 2009 (CCGEI 2009) aura lieu à St. John's, Terre-Neuve & Labrador, Canada du 3 au 6 Mai. CCGEI 2009 est un forum où les recherches et développements en génie électrique et informatique élaborés au Canada et dans le reste du monde sont exposés. Il y aura sept symposiums et les communications pourront être présentées aussi bien en français qu'en anglais.

- Circuits, Devices and Systems
Prés. : T.B.A
- Control and Robotics
Prés. : Andrew Vardy, Memorial U.
- Communications and Networking
Prés. : Cheng Li, Memorial U.
- Computers, Software and Applications
Prés. : Christian Couturier, NRC IIT
- Ocean Engineering
Prés. : Ferial El-Hawary, BH Engr
- Power Electronics and Energy Systems
Prés. : T.B.A.
- Signal and Multimedia Processing
Prés. : Octavia Dobre, Memorial U.

Les auteurs désirant soumettre des articles ne se rapportant pas avec aucun des thèmes présentés ci-dessus sont encouragés à le faire dans le cadre du symposium 'intérêt général'.

Soumission d'un article régulier

Veillez soumettre votre article complet au Comité de Programme Technique en utilisant la procédure de soumission en ligne sur notre site web <http://www.ccece09.org> avant le 5 Décembre, 2008. Cliquez sur "Appel de communications" et suivez les instructions fournies.

Soumission d'une proposition de tutorial et d'atelier

Les propositions pour une demi-journée de tutoriaux et d'ateliers devraient être soumises avant le 5 Décembre 2008 au Tutorials Chair à tutorials@ccece09.org.

Dates importantes

Date limite d'envoi d'article complet, le :	Vendredi 5 Décembre 2008
Date limite de proposition de tutorial et d'atelier, le :	Vendredi 5 Décembre 2008
Date d'annonce des résultats, le :	Vendredi 6 Février 2009
Date limite d'inscription des auteurs, le :	Vendredi 6 Mars 2009
Date limite d'inscription, le :	Vendredi 3 Avril 2009

Exposition industrielle et parrainages

Pour l'exposition industrielle, veillez contacter le chargé d'exposition industrielle à l'adresse exhibits@ccece09.org. Pour le parrainage, veillez contacter le chargé de parrainage à l'adresse sponsorship@ccece09.org.

Questions ou commentaires

Pour toutes questions ou commentaires, veuillez s'il vous plaît contacter le Secrétariat de la Conférence: Nora McEvoy. Tél: 709 737-7467 Fax: 709 737-4042 Courriel: contact@ccece09.org.

Conference Chairs

John Quaicoe
Memorial University
Wally Read
REMAS Inc.

Technical Program Chairs

Eric Gill
Memorial University
Dennis Peters
Memorial University

Tutorials and Workshops

Gerard Dunphy
NL Hydro

Finance

Paul Thorburn
NRC Inst. for Ocean Technology

Local Arrangements

Kathleen Chafe
Canadian Coast Guard

Publications

Geoff Holden
IONA Technologies

Registration

Octavia Dobre
Memorial University

Industrial Exhibits

Mike Janes, *Alliant*

Sponsorships

Craig Warren, *NL Hydro*

Translation

Yves Fontaine, *Bell Canada*

Student Activities

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CCECE 2009

22nd Annual Canadian Conference on Electrical and Computer Engineering

May 3-6, 2009, St. John's, Newfoundland & Labrador, Canada
<http://www.ccece09.org>

“From Electrons to Oceans: Innovation at Many Scales”

Preliminary Call for Papers and Proposals

The 2009 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE 2009) will be held in St. John's, Newfoundland & Labrador, Canada from May 3-6. CCECE 2009 provides a forum for the presentation of electrical and computer engineering research and development from Canada and around the world. Papers are invited, in French or English, for the following symposia.

- Circuits, Devices and Systems
Chair: T.B.A
- Control and Robotics
Chair: Andrew Vardy, Memorial U.
- Communications and Networking
Chair: Cheng Li, Memorial U.
- Computers, Software and Applications
Chair: Christian Couturier, NRC IIT
- Ocean Engineering
Chair: Ferial El-Hawary, BH Engr.
- Power Electronics and Energy Systems
Chair: T.B.A.
- Signal and Multimedia Processing
Chair: Octavia Dobre, Memorial U.

Authors wishing to submit papers that do not fit within any of the above topics are encouraged to do so to the 'general interest' symposium.

Regular Paper Submission

Please submit original full length paper(s) (maximum 6 pages) to the Technical Program Committee using the on-line submission process on our web site at <http://www.ccece09.org> before December 5, 2008. Click on "Call For Papers" and follow the instructions provided.

Tutorial and Workshop Proposals Submission

Proposals for half-day tutorials and workshops should be submitted before December 5, 2008 to the Tutorials Chair at tutorials@ccece09.org.

Important Dates

Full length paper must be received by:	Friday, December 5, 2008
Tutorial or workshop proposals must be received by:	Friday, December 5, 2008
Notification of acceptance will be sent out by:	Friday, February 6, 2009
Author's Registration ends by:	Friday, March 6, 2009
Advance Registration ends by:	Friday, April 3, 2009

Industrial Exhibits and Sponsorships

For industrial exhibits please contact the Industrial Exhibits Chair at exhibits@ccece09.org. For sponsorships please contact the Sponsorship Chair at sponsorship@ccece09.org.

Questions or Comments

For any questions or comments, please contact the Conference Secretariat: Nora McEvoy. Ph: 709 737-7467 Fax: 709 737-4042 Email: contact@ccece09.org

Conference Chairs

John Quaicoe
Memorial University
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Writing is Good for your Career

Introduction

One of the best ways to enhance your career and ensure your employability is by using and improving your writing skills. Effective writing portrays you and your employer in a positive light. It tells others how good your ideas and proposals are. This can pay off in respect, raises and promotions. Your writing is one very important part of your legacy to society.

A report entitled "Writing: A Ticket to Work... Or a Ticket Out" (September 2004) from the National Commission on Writing of the USA's College Board concluded tersely that good writing skills open professional opportunities while poor writing skills reduce opportunities. The 40-page report, based on a survey of 120 major American corporations employing nearly eight million people, is available on the commission's website (www.writingcommission.org). Major survey findings (pp. 3-4) include:

- Writing is a "threshold skill" for both employment and promotion.
- People who cannot write and communicate clearly are not likely to be hired or, if hired, not be considered for promotion.
- Two-thirds of salaried employees in large companies have some writing responsibility, and all employees must have writing ability.
- More than 40 percent of the responding companies offered or required training for salaried employees with writing deficiencies, costing as much as \$3.1 billion annually.

The implications of this survey are clear — for career success, effective writing skills are essential. The objective of writing is to share ideas and information, a central task of so many positions. Writing should be accurate, informative and entertaining; you want your audience to build the habit of wanting to read what you write.

Moreover, you have to write to become a better writer. When writing your first draft do not feel intimidated or limit yourself; simply let the words come out of your mind and onto the screen or paper. Don't be shy, write with passion and enthusiasm. Here are some general guidelines to help you become a better writer:

Plan

Start your writing by developing a strategy. Why am I writing this report, memo, letter, etc? What outcomes am I trying to achieve? Who is going to read the document? Most organizations have document standards that they expect their employees to follow. All publications provide potential authors with guidelines on what types of articles they are interested in and how they want manuscripts submitted. Be sure and follow the publications guidelines; they remove obstacles to publication, and can never really stop you from being expressive.

Organize

Writing progresses logically from the opening paragraph, to the body, through to the concluding paragraph. Write a strong but simple opening paragraph to capture the reader's attention. This will motivate your audience to continue reading. The opening establishes your credibility as well as qualifying and governing factors. In subsequent paragraphs put the most important information up front. A well constructed paragraph

Writing for the IEEE Canadian Review

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By *Terrance Malkinson*

Communications Specialist, Business Analyst and Futurist

Abstract

Using and improving your writing skills will enhance your career and increase your employability. This article presents a rationale, some concise guidelines, and a call for contributing to the IEEE Canadian Review.

Sommaire

L'utilisation et l'amélioration de vos talents d'écriture feront progresser votre carrière et augmenteront votre employabilité. Cet article présente un exposé raisonné, un guide concis, et un appel à contribuer à la Revue canadienne de l'IEEE.

communicates one main idea and provides authoritative specific support for the idea. The conclusion reviews and summarizes the important message of the document. It may also suggest next steps.

Content

Writing should be focused on outcomes and expediency. Effective writing is powerful and clear. Say things completely but in as few words as possible. Every word should be an essential piece of the message. Each sentence is a group of words that expresses a complete thought and must be able to stand alone.

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When writing for a broad audience or for people who are unfamiliar with your work, avoid jargon, acronyms and technical terms as they may induce confusion. However, if you are writing for a targeted audience then these terms may be acceptable; IMHO.

Document Review

Write, re-write and re-write again. Good writing is hard work. Once you have created your document put it aside for awhile. Later, review, proof-read and correct the final version. Have someone who has characteristics similar to your target audience read the document and welcome their suggestions. *Continued next page*

About the Author

Terrance Malkinson is a communications specialist, business analyst and futurist. He is an elected Senator of the University of Calgary and 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 associate editor for *IEEE Canadian Review*. He was an elected Governor of the IEEE Engineering Management Society and was an elected Administrative Committee member of the IEEE Professional Communication Society, editor of several IEEE conference proceedings, and past editor of *IEEE Engineering Management*. He is the author of more than 320 publications and is also an accomplished triathlete. Currently retired, previously he was an accomplished technical supervisor and medical researcher at the University of Calgary and a business proposal manager for the General Electric Company. The author is grateful to the professional support of the Haskayne School of Business Library at the University of Calgary. He can be reached at malkinst@telus.net



Education

Primary, secondary and post-secondary educational institutions must be provided with the resources and incentives to educate our youth – and adults! – in writing skills. A further report by the National Commission “Writing and School Reform” available on the same website focuses on how to tackle the challenge of increasing the amount of time students spend writing. Take the time to communicate to your school and political officials the importance of ensuring that the next generation has good writing skills. Writing is increasingly essential for personal and professional success.

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The conference will take place on the campus of Concordia University in Montréal, Canada, and will consist of paper presentations and panel discussions that focus on communication, design, managerial, and cultural aspects of the information economy.

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- Presentations and panels by some of the leading researchers and practitioners in professional communication
- A continuing education unit (CEU) track that will allow participants to earn 1 CEU through Texas Tech University (see <http://ewh.ieee.org/soc/pcs/?q=node/176>)

Kirk St.Amant
Conference Chair
ipcc2008@gmail.com

A Medium Voltage AC Drive for Oil Sands Applications

1.0 Introduction

There has been significant research and development in Medium Voltage (1 kV to 7.2 kV) drive technology in recent years. This has resulted in a number of manufacturers offering various product solutions to the industrial user for asynchronous and synchronous motors [1-4]. However, there are two very different approaches being used by the equipment manufacturers for serving the needs of industry. One solution is the series connection of low voltage inverter modules to achieve the required motor voltage. This approach uses a complex multi-winding transformer and existing low voltage technology connected in series. The other solution uses higher voltage semiconductor components, ranging from 3.3 kV to 6.5 kV, for implementation in two and three level inverters. An overall reduction in component count results, with the likelihood of reducing cost and increasing reliability. The manufacturers of the two and three level structures are further divided by offering voltage source and current source PWM structures. For each of these there is the possibility to use either a MOS device structure, IGBT or a bi-polar device structure, GTO or GCT.[5] *

* N.Ed. See Table 1 - Acronyms at the end of the article.

The requirements of the industrial user vary depending on the application and environmental conditions. However, AC drives are often required to meet harmonic standards such as IEEE-519 guidelines, provide motor-friendly waveforms, high efficiency, high reliability, ease of use and low capital cost.

The main objectives of this paper are to: 1) provide a brief overview of the state of the art medium voltage AC drive topologies; 2) describe in more detail one of the market leading topologies, namely the PWM current source with Active Front End and 3) provide implementation examples in oil sands applications where significant energy savings can be achieved.

The proposed AC drive is known as a PWM CSI with PWM Rectifier front end, and does not need an isolation transformer. Symmetric Gate Commutated Thyristors (SGCT) operating at 400-600Hz are used in both the inverter and rectifier ⁶. A patented common mode inductance integrated with the dc link is used to eliminate the Common Mode Voltage within the system so that standard (no inverter duty) motors can be used.

2.0 Topologies used in Medium Voltage drives

The two main drive categories are shown in Fig. 1. The current source in Fig. 1a is characterized by a phase control thyristor or pulse width modulation (PWM) rectifier and DC link inductor for 'stiff' current supply. Fig. 1b shows a voltage source characterized by a diode rectifier or PWM rectifier and DC link capacitor for 'stiff' voltage supply.

2.1 Voltage Source Topologies

There are four types of VSI drives available. There is the two-level topology, shown in Fig. 2 on the following page, which could be considered

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Abstract

Medium Voltage AC drives have been the subject of extensive research in recent years. The quest for the best topology suited for Medium Voltage industrial applications has resulted in various distinct solutions. Some use a complex multi-winding transformer and series connection of low voltage modules to achieve the required output voltage; others promote a simpler multi-winding transformer - or no transformer - and the use of medium voltage semiconductors to reduce component count, thus lowering complexity.

This paper provides a brief overview of the available Medium Voltage AC drives and describes one of the market-leading topologies in more detail. This MV drive is based on a PWM current source inverter with an active front end and offers sinusoidal current and voltage waveforms both at the motor side and line. A common mode inductance is used in the dc link section to eliminate the need for an isolation transformer hence reducing cost, size and increasing the efficiency. The paper also discusses a variety of Oil Sands applications including reciprocal/slurry pumps, fans and conveyors where PWM-CSI drives have been successfully used.

Sommaire

Les variateurs de vitesse pour moteur asynchrone moyenne tension (MT) ont été le sujet de recherche exhaustive au cours des dernières années. La quête pour identifier la meilleure topologie adaptée aux applications industrielles à moyenne tension a mené à plusieurs solutions. Certaines utilisent un transformateur complexe à enroulements multiples avec couplage en série des modules à basse tension pour obtenir la tension désirée; d'autres préfèrent un transformateur plus simple ou aucun transformateur et l'utilisation de semiconducteurs à moyenne tension pour réduire le nombre de composants, diminuant ainsi la complexité.

Cet article fournit un bref aperçu des variateurs moyenne tension disponibles et décrit en détail une des principales topologies utilisées. Ce variateur MT est basé sur un onduleur à modulation par largeur d'impulsions (MLI) avec un redresseur d'entrée aussi à MLI afin que les courants et les tensions de ligne et du moteur soient sinusoïdaux. Une inductance de mode commun est utilisée dans la section du lien cc pour éliminer le besoin d'un transformateur d'isolation, réduisant ainsi coût et dimensions et augmentant l'efficacité. Cet article présente aussi une variété d'applications pour les sables bitumineux incluant des pompes à boue, des ventilateurs et des convoyeurs où les variateurs MLI à moyenne tension ont été utilisés avec succès.

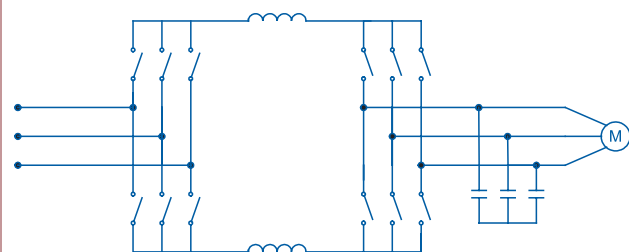


Fig. 1a. Generic structure of a Current Source drive

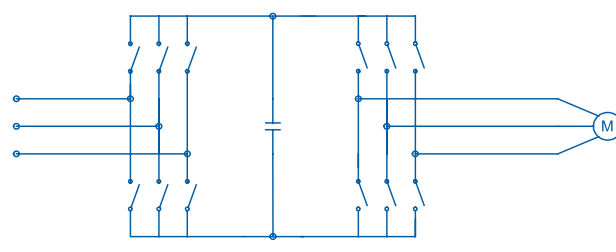


Fig. 1b. Generic structure of a Voltage Source drive

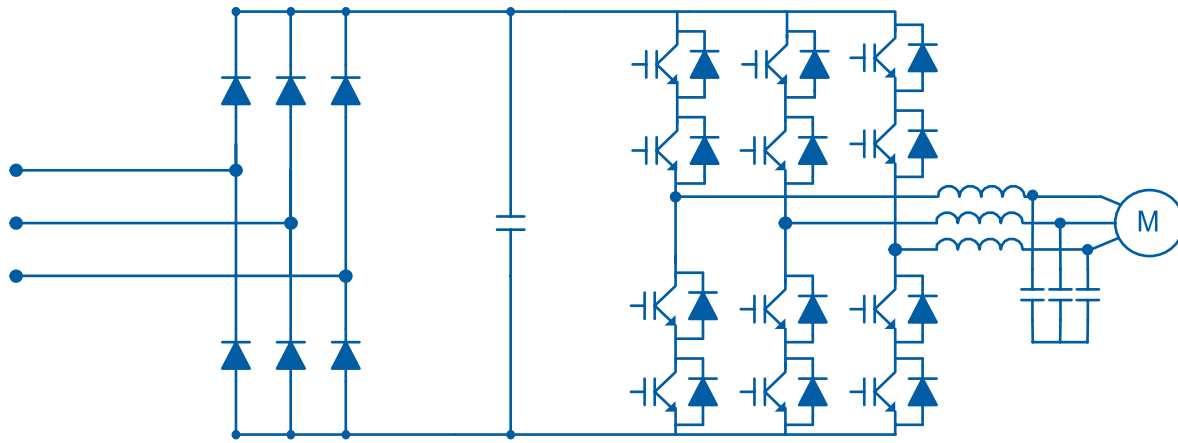


Fig. 2: Two-level Voltage Source AC drive

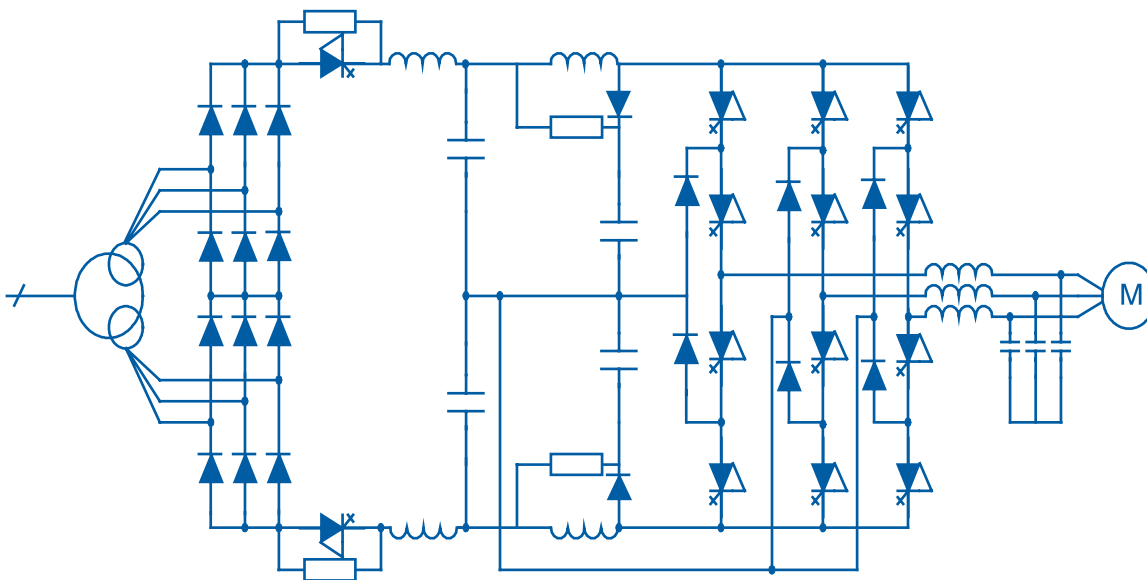


Fig. 3: IGCT based three-level Voltage Source AC drive

the ‘dual’ of PWMCSI, the three-level topology (also known as Neutral Point Clamped, NPC), the series connected H- Bridge and the series connected NPC configuration.

Other VSI variations exist, such as the flying capacitor multi-level topology or five level and higher, but these are not considered in standard applications. The two-level topology is very simple and dominant at low voltage but not readily available in the marketplace at Medium Voltage levels. It is characterized by a diode front end, large filter capacitor and series connected IGBTs in the inverter. The three-level topology is shown in Fig. 3. It is characterized by a diode front end usually 12 or 24-pulse, which could be substituted with a three-level Integrated Gate Commutated Thyristors (IGCT) or IGBT PWM rectifier, a large DC link capacitor, a three-level IGBT or IGCT inverter. There can be minor changes in the topology based on the power semiconductor used. The design shown in Fig. 3 is based on IGCTs. The IGBT based designs usually can avoid using the clamp circuit but would require a more integrated power module design to reduce the stray and loop inductances as much as possible. To achieve motor-friendly waveforms these circuits would require an output filter, the size of which depends on the switch-

ing frequency and gating pattern used in the inverter.

The series connected H-bridge topology, shown in Fig. 4a, is characterized by a multi-winding transformer usually having 9, 12, or 15 secondary windings. Each winding set is connected to a cell comprised of a three-phase diode bridge rectifier, electrolytic filter capacitor bank, and an IGBT H-bridge. The output of each cell is connected in such a way as to build the voltage to the required value. This is an older topology which was required due to the limited voltage capability available in IGBTs at the time resulting in high component count and lower reliability so that redundant components are a standard option. A variation of the H-bridge topology is the multi-level NPC configuration which is shown in Fig. 4b. All the above topologies can meet the IEEE-519 harmonic guidelines (with the exception of the 12pulse front end) through use of the multi winding input transformers. None of the above achieves regeneration since all use diode front-end rectifiers. The three-level topology could be combined with an Active Front End (AFE) to achieve a four quadrant operation. However, the AFE version has not been very popular so far, perhaps due to the added cost and increased voltage stress on the rectifier side semiconductors.

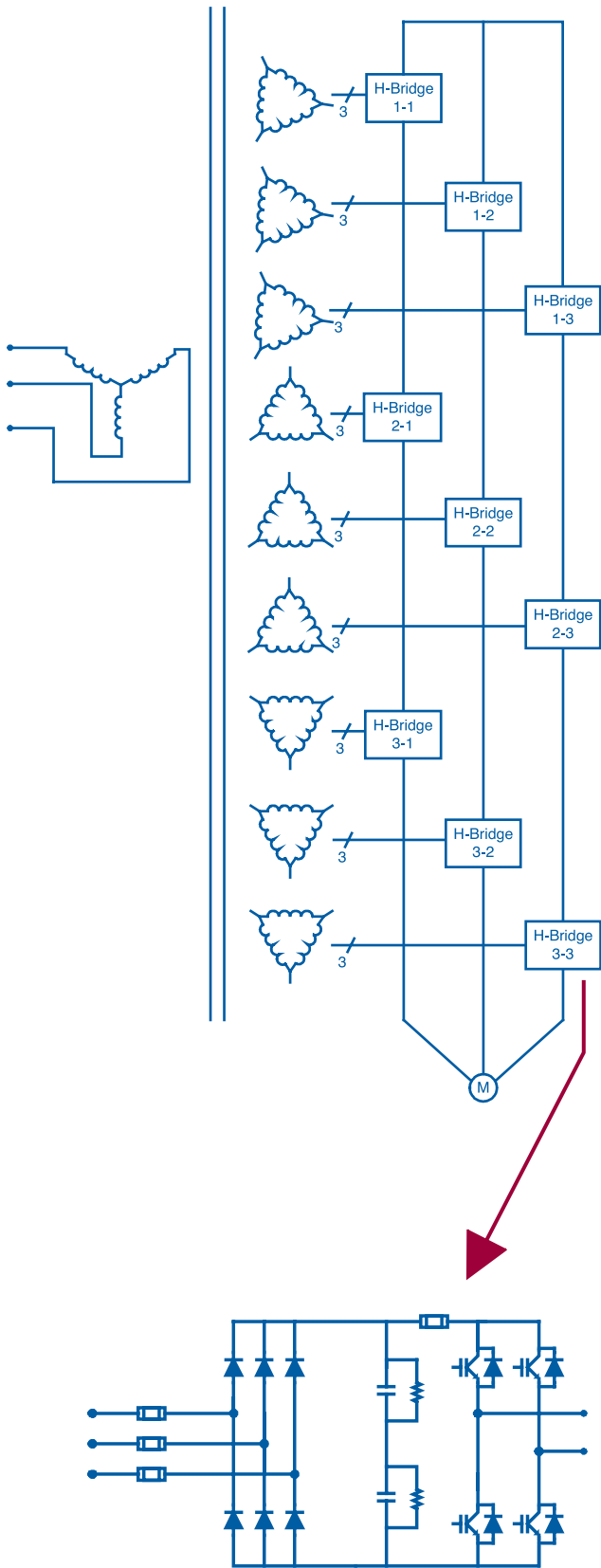


Fig. 4a. A multi-level H-bridge type Voltage Source AC drive

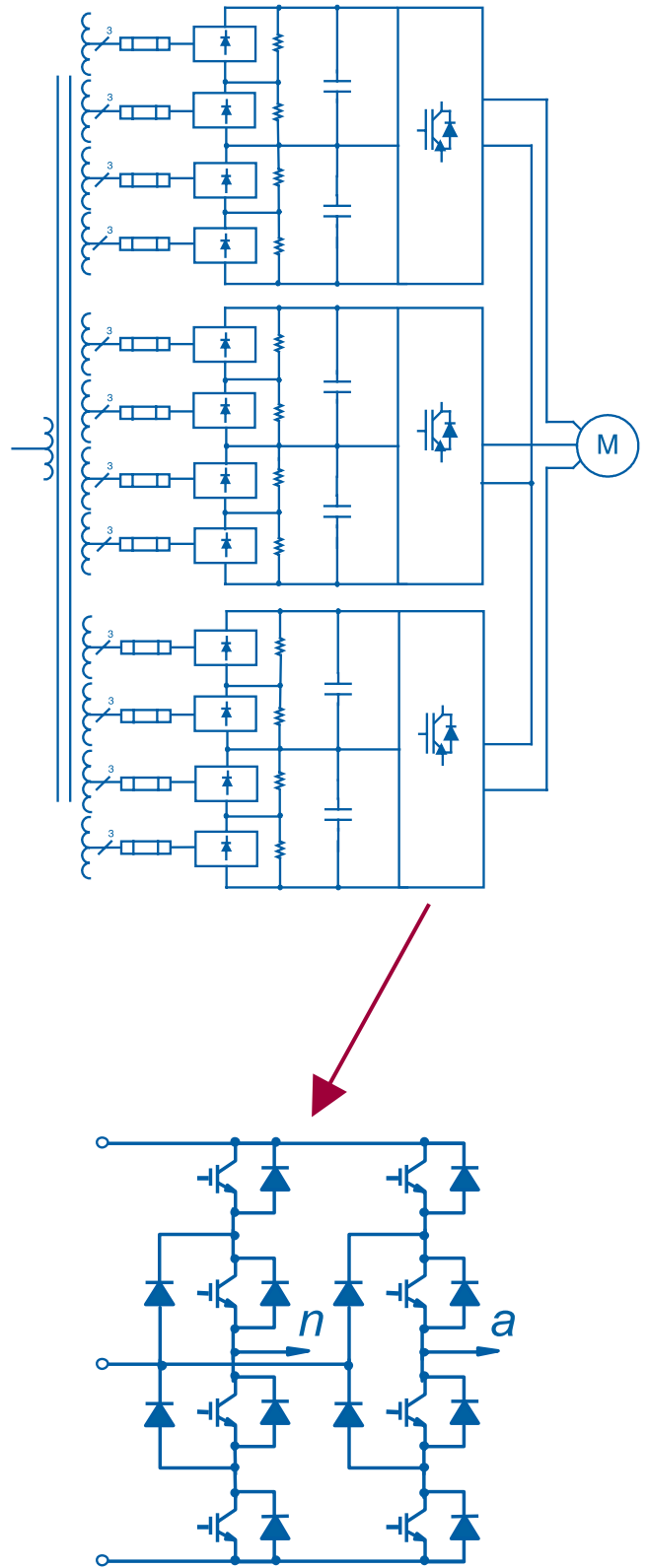


Fig. 4 b. A multi-level NPC type Voltage Source AC drive

2.2 Current Source Topologies

The Current Source topology has gone through evolution over many years. In the late 1980's the Pulse Width Modulated Current Source Inverter (PWMCSI) was introduced. This topology is characterized by an SCR rectifier, a DC link inductor, a GTO inverter and a medium size filter capacitor, in the range of 0.4 to 0.6 per unit. A new version recently introduced is the Pulse Width Modulated Current Source Inverter with Symmetric Gate Commutated Thyristors (PWMCSI-SGCT) shown in Fig. 5. This topology is characterized by an SGCT PWM rectifier, a smaller DC link inductor, an SGCT inverter eliminating the polarized snubber required for GTOs and a smaller filter capacitor, in the range of 0.20 to .40 per unit. Fig. 6 shows a picture of a 4160V current source drive system. The left cabinet contains an advanced digital controller for the drive and the line- and motor-side filter capacitors. The middle cabinet houses two identical PWM converters, one for the rectifier and the other for the inverter. Each converter is composed of 12 pieces of SGCTs. The dc choke and air-cooling system are installed in the right cabinet. A more recent variation of this topology uses a modified DC link with high common mode inductance, designed to eliminate the common mode voltage and hence the need for an isolation transformer. This topology is described in the next section in more details.

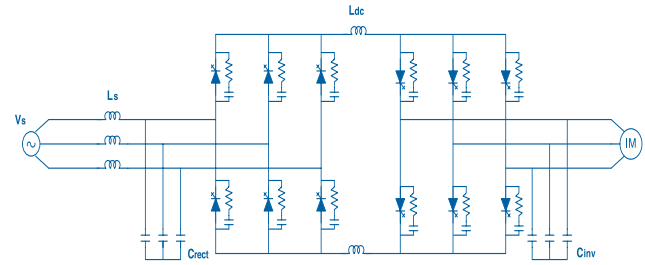


Figure 5: Current source topology characterized by SGCT based PWM-CSI drive with an active front end



Fig. 6: An installed 4160V current source drive system

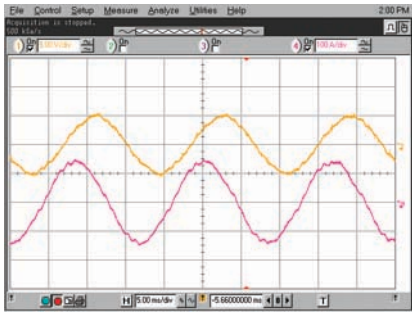


Fig. 7: Input voltage and current waveforms at rated load and speed (1250hp, 4160V) Trace 1: 6000V/div ($THD_v=2.3\%$), Trace 2:100A/div ($THD_i=4.3\%$)

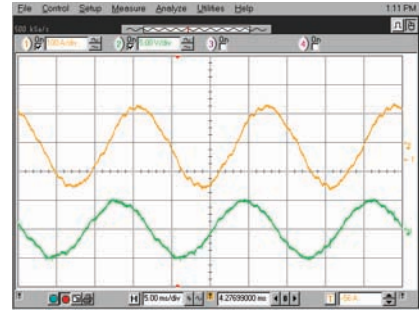


Fig. 8: Motor current and voltage waveforms at rated load and speed (1250hp, 4160V) Trace 1:100A/div, Trace 2: 6000V/div

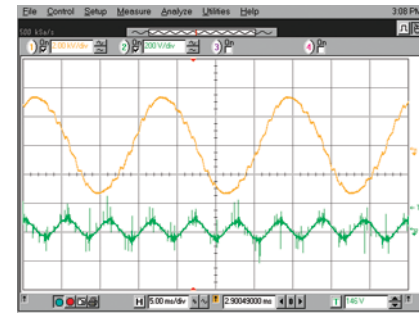


Fig. 9: The motor line to ground and neutral to ground voltage waveforms at rated load and speed (1250hp, 4160V)

3.0 Description of the AC Drive System

The proposed drive system is based on the Current Source Topology, previously referred to in Fig. 5. The power circuit and control scheme are described next.

3.1 The Power Circuit

The system has current-source characteristics at the DC terminal (DC side reactor) and voltage-source characteristics at the ac terminal (AC side capacitors). Operating the semiconductor switches in the converters interfaces the AC and DC sides. These switches must be operated so as to avoid an open circuit on the DC side or a short circuit on the AC side. This means that at any given time there are only two switches conducting, one in the top half of the bridge and one in the bottom half. The criteria are valid for both the rectifier and the inverter.

The rectifier switching pattern and frequency are fixed and depend on the supply frequency. The input filter capacitors are designed to provide a low pass filter in conjunction with the power source impedance or an additional line reactor. The resonant frequency of this filter is placed in a range where no harmonics exist. This can be ensured by adapting a Selective Harmonic Elimination (SHE) pattern for the rectifier (for example if the 5th and 7th harmonics are eliminated, one can design the filter to have a resonant frequency of around the 6th harmonic). Other factors that affect the design of the capacitors are the input Power Factor and the Total Harmonic Distortion of the input waveforms. A near unity Power Factor at full speed/full load and a low THD input voltage and current waveforms to meet the IEEE-519 are achieved. The line current and voltage waveform at full speed/full load for a 1250hp/4160V drive

are shown in Fig. 7. The source short circuit MVA is less than 50 and a 4.3% line current THD is achieved.

The inverter switching pattern and frequency are dependent on the speed/load requirements. The output capacitors are designed to absorb the high frequency current harmonics and result in a near sinusoidal current and voltage waveforms at the motor terminal. They are designed to avoid amplifications of system natural resonant frequencies, which is easy to achieve since the inverter switching pattern is used to eliminate the 5th, 7th and 11th harmonics (at full speed) and create a harmonic-free zone where the filter resonant frequency can be placed. As the motor speed is reduced, the number of harmonics that are eliminated increases to always ensure the existence of this “harmonic-free” zone. The motor voltage and current waveforms for a 4160V/1250hp drive are shown in Fig.8. It can be seen that both voltage and current waveforms are sinusoidal and there are no dv/dt issues (as is the case for the VSI drives). The switching pattern is changed to Space Vector Modulation (SVM) at low speeds to improve the quality of output waveforms. The line-to-ground and neutral-to-ground voltages are shown in Fig. 9. The peak neutral voltage is less than a few hundred volts which is comparable to that of across-the-line applications. This means there is no need for an “inverter duty” motor or increased insulation in the motor even though no input transformer is used.

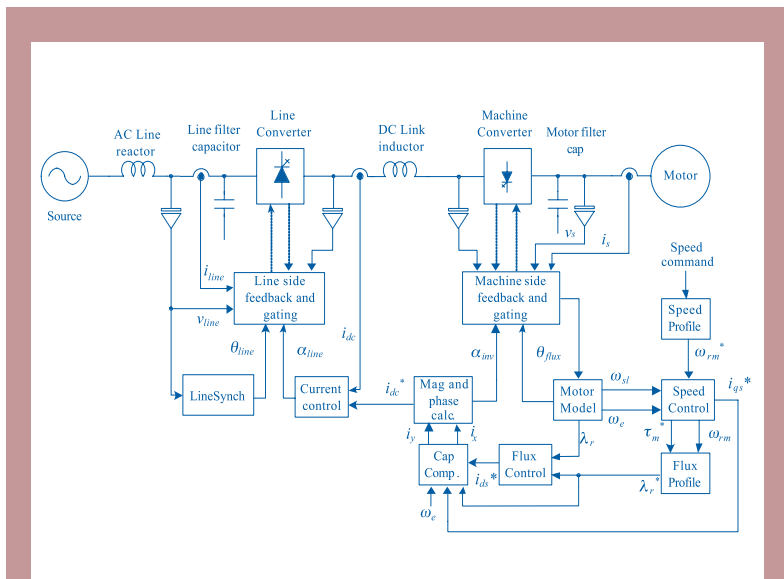


Fig. 10: Block diagram of a vector controlled PWM CSI drive

3.2 The Control Circuit

The proposed drive system uses direct sensor-less vector control in which the position of the stator current vector is controlled relative to the measured motor flux vector. Sensor-less operation indicates that the motor speed is estimated from the measured drive variables and parameters. The stator current is resolved into flux and torque-producing components by the flux and the speed control regulators, respectively. Both control loops operate independently. A block diagram representation of the drive control system is shown in Fig. 10.

In direct field-oriented control, the magnitude and position of the rotor flux to which the synchronously rotating reference frame is aligned, is directly calculated from the terminal measurements of the motor voltages and currents using a flux model given by:

$$\lambda_r^s = \frac{L_r}{L_m} \left[\int (v_s^s - R_s i_s^s) dt - \sigma L_s i_s^s \right] = |\lambda_r| \langle \theta_f \rangle \quad (1)$$

The stator frequency (ω_{se}) is measured as the derivative of the rotor position from which the motor speed is estimated by calculating the slip frequency. The speed PI regulator determines the required motor torque (T_m^*) from the speed error from which the q component of the stator current command (i_{qs}^*) is calculated as:

$$i_{qs}^* = \frac{T_m^*}{k_f \lambda_r^*} \quad (2)$$

The flux reference (λ_r^*) is selected based on the load profile and motor speed. The rotor flux feedback (λ_r) is then compared with the flux reference and the error processed by a PI regulator to produce the magnetizing component (i_{ds}^*) of the stator current. As seen in Fig. 9, the current supplied by the inverter includes the current fed to the induction machine and the current drawn by the capacitors. Hence after determining the torque (i_{qs}^*) and field (i_{ds}^*) producing components of the stator current, the capacitor components have to be added to determine the current supplied by the inverter. The torque and flux component of the current supplied by the inverter are calculated as:

$$i_x = (1 - \omega_{se}^2 C_o \sigma L_s) i_{ds}^* - \omega_{se}^2 C_o \frac{L_m}{L_r} \lambda_r^* - \omega_{se} C_o R_s i_{qs}^* \quad (3)$$

$$i_y = (1 - \omega_{se}^2 C_o \sigma L_s) i_{qs}^* + \omega_{se} C_o R_s i_{ds}^*$$

The inverter output current magnitude is controlled by adjusting the dc link current given by

$$i_{dc}^* = k \sqrt{i_x^2 + i_y^2} \quad (4)$$

where k is a constant dependant on the modulation index of the inverter PWM pattern. The vector position of the inverter current is controlled by adjusting the phase shift of the gating pattern with respect to the synchronously rotating excitation frame given by:

$$\alpha_{inv} = \tan^{-1} \left(\frac{i_y}{i_x} \right) \quad (5)$$

The current controller maintains the required dc link current (i_{dc}^*) by providing the phase shift information to the rectifier gating pattern generator. The response time of this control algorithm is more than adequate for most industrial applications such as pumps, fans, conveyors and extruders. Some of these applications are discussed below.

4. Oil Sands Applications

The Canadian Oil sands is possibly the fastest growing oil-producing region in the world largely due to the combination of global requirements for energy and the stability and security of supply in this region. Production is expected to increase from an estimated 1 million barrels per day (2004 figure) to 2 million barrels per day by 2012 and ultimately 5 million by 2030.

Current extraction techniques are very energy intensive. Energy savings and efficiency are major consideration for oil producers, which lead to extensive use of AC drives especially at Medium Voltage levels. Perhaps the largest installed base of Adjustable Speed Drives (ASDs) in the world is to be found in the Fort McMurray region with a vast majority of the large drives being of the PWM-CSI design as described in the paper.

There are several different techniques which may be employed to extract the bitumen from the sand with the primary determining factor being the depth of the deposit. In cases where the oil sand is relatively close to the surface, the economics justify the more conventional open pit mining

approach where overburden on the surface is removed to expose the sand which is hauled away using a combination of trucks and conveyors to introduce the oil sand into the process. Further handling of the oil sand involves the use of apron feeders and rotary breaks in order to both transport the material and begin the breakdown of the material. Next is the pumping action and the addition of diluents to create a froth from which the oil is extracted. At depths which are impractical to use open pit mining, other processes such as SAGD (Steam Assisted Gravity Drainage), THAI (Toe to Heel Air Injection) as well as ‘‘Huff and Puff’’ are used.

All methods involve the heating of the tar sand in order to lower the viscosity of the bitumen. SAGD (Fig. 11.) is the most common of the approaches involving the production of steam which is injected into the deposit. In SAGD, horizontal wells are drilled in the oilsand deposit, some of which are used to deliver steam, others to collect the watery bitumen that results from the flow. The water and bitumen are brought to the surface either by the lift produced by the steam or natural gas which may be injected by PCPs (Progressive Cavity Pumps). A few typical Oil sand applications are described in the following sections.

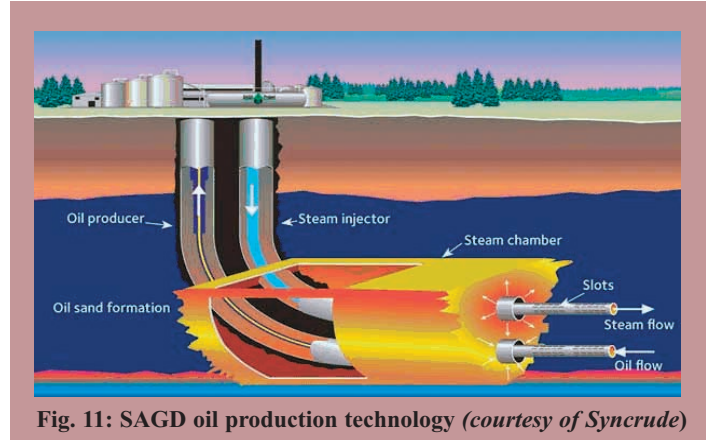


Fig. 11: SAGD oil production technology (courtesy of Syncrude)

Pumps

Fans and pumps represent the vast majority of loads worldwide and the oil sands process is no exception. These are typically known as variable torque application where the load torque is proportional to the square of the speed of the pump, requiring very low torque at low speeds, low speed bandwidth and little overload capability. There are a wide variety of pumps involved in the handling of water, bitumen and sand involved in the extraction process as well as the transportation of bitumen and the end product. The pump type will depend on the viscosity, temperature and nature of the fluid. A pump application specific to the open pit mining process is the slurry pump discussed below.

Slurry Pumps

Slurry pumps are specialized centrifugal machines intended to pump fluids with a relatively high concentration of solids. These pumps are used to transport oil sand in solution from mining to the froth process and the resultant tailings extracted in the froth process to large containment and settling ponds for disposal. Slurry handling represents the largest load component at an open pit oil sand facility involving a number of multiple large motors over each slurry train.

Each slurry pump has a defined operating curve giving the required horsepower over a speed range to suit the application of the pump at a specific fluid density. The highest possible operating Specific Gravity (SG) of the slurry must be used in torque calculations and the drive selection to provide satisfactory service. Pump performance is adversely affected by solids in slurry due to increased friction losses in the pump which leads to rapid wear of pump casings and impellers. Studies have shown that this application is well suited to the use of ASDs since the life of these components are dramatically extended when speed of operation is reduced at lower flow requirements. The wear rate is proportional to the speed of the pump raised to the 2 1/2 power which means that a 50% speed reduction will result in a 600% increase in expected life.

Conveyor / Apron Feeder / Rotary Break Applications

There are conveyor belt and rotary break applications in the initial material handling process (Fig. 12). These are different from typical pump loads since they have constant torque load profiles. Apron feeders' characteristics are similar to the more common conveyor belt drives but uti-

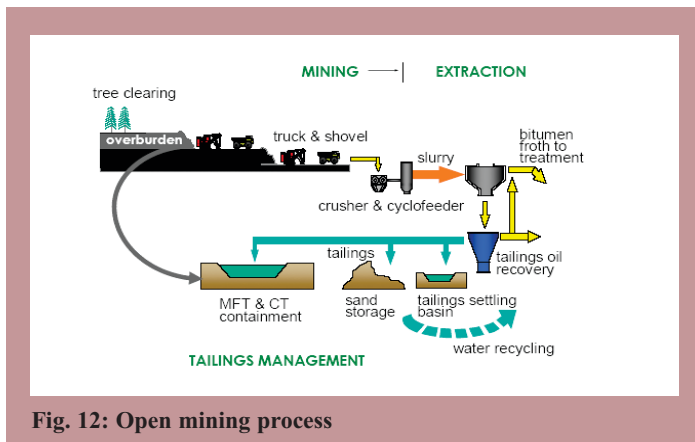


Fig. 12: Open mining process

lize metal belts and often have more demanding load torque profiles in their “upset” conditions which include cold starts with loaded belts and cyclic overloads. The high start up load requirement can be achieved by using ASDs without the need for over sizing motors. This is particularly beneficial in the case of large machines with poor locked rotor or starting torque (50-80% of rated), which may make it impossible to start these loads across the line.

Conclusion

Following a brief overview of AC drive topologies used in Medium Voltage Applications, we presented a Current Source type MV AC drive - a proven technology in use since early 2000 that is common in the demanding environment of the Canadian Oil Sands. Extensive and judicious application of Adjustable Speed Drives in such applications could be most beneficial in terms of efficiency and energy consumption.

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He has been with the Medium Voltage R&D Department of Rockwell Automation, Cambridge since November 1994, first as a senior designer and currently as the manager of the Department. For the past 10 years he has been involved with simulation, analysis and design of power converters for Medium Voltage AC drives. His research interests include power converter topologies and their control aspects, high power factor three phase rectifiers, VAR compensators, power semiconductor and renewable energy sources. Dr. Zargari is registered as a Professional Engineer in the Province of Ontario and is a Senior member of IEEE. He has co-authored more than 35 research papers and holds 6 US patents.

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His research interests include power converter topologies and their control aspects.

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MV	Medium Voltage
SGCT	Symmetric Gate Commutated Thyristor
PWM	Pulse Width Modulation
SG	Specific Gravity
ASD	Adjustable Speed Drive
SAGD	Steam Assisted Gravity Drainage
PCP	Progressive Cavity Pump
THAI	Toe to Heel Air Injection
SVM	Space Vector Modulation
CSI	Current Source Inverter
IEA	International Energy Agency
VSI	Voltage Source Inverter
NPC	Neutral Point Clamped
FOC	Field Oriented Control
SHE	Selective Harmonic Elimination
MOS	Metal-Oxide Silicon
GCT	Gated Commutated Thyristor
IGBT	Insulated Gate Bipolar Transistor
GTO	Gate Turn-Off Thyristor
AFE	Active Front End
AC	Alternating Current
DC	Direct Current
IEEE	Institute of Electrical & Electronic Engineers
PI	Proportional & Integrating (Regulator)
THD	Total Harmonic Distortion
MVA	Mega Volt Amperes
kV	Kilovolts

Table 1 -Acronyms

Engineering Management: What's New in the Literature?

On: Net Addiction, Multigenerational Workforce, Work Policies, Team Collaboration and Communication, Creative Design, Innovation, Corporate Libraries, The Future of Learning and Work, The 50 Who Matter, and Followers.

by Terrance Malkinson

Governor — Engineering Management Society

◆ Surfing the Internet at work has become a serious problem in many organizations. In “Caught in the Web” [*HR Magazine*, 52(12):35-39, December, 2007. www.shrm.org/hrmagazine], Adrienne Fox discusses internet addiction and how the employer has the choice of providing discipline or treatment. In the article's introduction, the results of a 2006 study are presented in which one in eight Americans exhibit at least one possible sign of problematic Internet use. An interesting inset provides graphical information on how employees use the internet at work and another inset provides readers with warning signs of internet addiction. Rather than simply terminating employment, Fox suggests that education and rehabilitation is the preferred approach to deal with the Internet addiction problem.

◆ Worksites are increasingly multigenerational. Each generation has different communication styles, work habits, and attitudes about technology. In: “Training Tomorrow's Workforce” [*T&D*, 61(4):58-60, April, 2007. www.astd.org/TD], Janice Ware, Rosemary Craft, and Steve Kerschenbaum discuss how workplace training and technology will need to fit both the learning styles and the lifestyles of a multigenerational workforce. All age groups need to understand the diversity of the multigenerational workforce and learn how to work together effectively to bridge the generation gap.

◆ In today's tight employment market employers are looking at every possible way to retain their best employees. In “Flexible Work Policies Mean Business” [*T&D*, 61(4):32-36, April, 2007. www.astd.org/TD], Paul Harris discusses flexible work policies that allow employees to balance work and family life. For many employers the implementation of flexible work policies is simply a matter of good business as it improves employee satisfaction and satisfied employees will result in business success.

◆ As the complexity of projects increase, the size of teams is growing, and in some cases the team can consist of 100 or more members. Practices that work well with smaller teams are not effective for large teams. Results from a research project studying team dynamics and the environment of 55 large teams is provided in “Eight Ways to Build Collaborative Teams” [*Harvard Business Review*, 85(11):101-109, November, 2007. www.hbr.com], Lynda Gratton and Tamara Erickson discuss eight success factors that emerged from their research.

◆ Mistakes often occur because team members fail to communicate effectively. In “Are Your Engineers Talking to One Another When They Should?” [*Harvard Business Review*, 85(11): 133-142, November 2007. www.hbr.com], Manuel Sosa, Steven Eppinger and Craig Rowles provide information that will help prevent communications failures, particularly with design complex and highly engineered products. The authors discuss a new application of a project management tool, the design structure matrix, which maps the flow of information and its impact on product development. This approach identifies areas where communication should be occurring but is not, and areas where communication is occurring but has not been planned for.



◆ We are always seeking ways to design educational programs that will enhance our ability to be creative and innovative. In “The Talent Hunt” [*BusinessWeek*, #4054, pp. 54-59, October 15, 2007. www.businessweek.com], Elizabeth Woyke and Maha Atal discuss design programs that are shaping a new generation of creative managers. Further *BusinessWeek* information on the subject is accessible special report at: www.businessweek.com/innovate/di_special/20071005_d-schools.htm

◆ Information training can be an important employee benefit and enhances the value of the corporate library. In “The Personal Information Trainer” [*Information Outlook*, 11(11):11-17, November, 2007. www.sla.org/content/Shop/Information/], Stuart Basefsky discusses, from the viewpoint of the library information specialist, the value of the corporate library to an organization and its employees.

◆ A report on the thoughts of eight futuristic thinkers forecasting their expectations about the worker and workplace is provided in “The Future of Learning and Work” [*Training and Development*, 61(12):40-44, December, 2007. www.astd.org/TD]. Issues discussed include: skills that will be most important, workplace training, attracting and retaining top talent, management style, organizational skill gaps, and others. A focus for attracting and retaining top talent is the employer providing the opportunity for professional development. New employees place high value on continuing education and growth and will look for this opportunity from their employer.

◆ Fifty people, products, trends, and ideas that are transforming the world of business are provided in “The 50 Who Matter Now” [*Business 2.0*, 8(6):56-65, July, 2007. www.business2.com]. Each of the 50 profiles is short and all are interesting reading on why these subjects matter and why they should not be ignored.

◆ As a manager or as an employee it is important to understand that the work group is not an amorphous group. Today's workplace is diverse and employees are influenced by a wide range of cultural and technological changes. In “What Every Leader Needs to Know About Followers” [*Harvard Business Review*, 85(12):84-91, December, 2007. www.hbr.com], Barbara Kellerman explores differences among followers. These differences have important implications for the way that managers should manage. The author discusses the characteristics of five types of followers; isolates, bystanders, participants, activists and diehards.

◆ The Japanese government recently created long-term strategic guidelines for the creation of innovation for growth. This is a long-term plan to be realized by 2025. In: “The Vision of Innovation 25” [*Tech Monitor*; 24(5):39-43, Sept-October, 2007. www.apctt.org], Kumi Okuwanda describes discussions that went into the development of the guidelines and the guidelines themselves that are designed to open up Japan to the world community. Innovation in this context goes beyond technological improvement to include Japanese social systems and institutions.

For author's biography, see page 29.

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WEST ...

Int'l Symposium on Advanced Control of Industrial Processes (Adconip)

2008-05-04...06, Jasper, AB
<http://www.adconip2008.org>

IEEE Instrumentation & Measurement Technology Conference (IMTC)

2008-05-12...15, Victoria, BC
http://www.ieee-ims.org/imtc/imtc_2008.php

IEEE Int'l Symposium on Electrical Insulation (ISEI)

2008-06-09...12, Vancouver, BC
<http://www.deis.nrc.ca/calendar.htm#2008>

14th Symposium on Electromagnetic Launch Technology (EML)

2008-06-10...13, Vancouver, BC
<http://www.emlsymposium.org>

14th IEEE Int'l Mixed-Signals, Sensors, and Systems Test Workshop (IMS3TW 2008)

2008-06-18...20, Vancouver, BC
<http://www.lirmm.fr/~w3mic/IMS3TW08/>

30th Annual Int'l Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)

2008-08-20...25, Vancouver, BC
<http://www.embc2008.com/>

IEEE Vehicular Technology Fall Conference (VTC)

2008-09-21...24, Calgary, AB
<http://www.vtc2008fall.org>

40th North American Power Symposium - NAPS

2008-09-28...30, Calgary, AB
<http://www.naps2008.net/>

IEEE Industry Applications Society Annual Meeting

2008-10-05...09, Edmonton, AB
<http://www.ieee.org/ias2008/>

Electrical Power & Energy Conference (EPEC)

2008-10-06...07, Vancouver, BC
<http://www.ieee.ca/epec08/>

2nd IEEE Int'l Conference on Digital Game and Intelligent Toy Based Learning (DIGITEL 2008)

2008-11-17...19, Banff, AB
<http://www.ask4research.info/digitel/2008/>

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

2008-11-19...21, Edmonton, AB
<http://ewh.ieee.org/soc/ias/tmp/>

IEEE/IAS Industrial & Commercial Power Systems Technical Conference (I&CPS)

2009-05-03...07, Calgary, AB
<http://ewh.ieee.org/soc/ias/tmp/>

IEEE 31st International Conference on Software Engineering (ICSE)

2009-05-16...23, Vancouver, BC
<http://www.cs.uoregon.edu/events/icse2009/>

IEEE Power Engineering Society General Meeting

2009-07-26...30, Calgary, AB
<http://www.ieee.org/power>

IEEE International Conference on Ultra-Wideband (ICUWB)

2009-09-09...11, Vancouver, BC
<http://www.icuwb2009.org>

CENTER ...

21st IEEE Canadian Conference on Electrical and Computer Engineering (CCECE-CCGEI)

2008-05-04...07, Niagara Falls, ON
<http://www.ccece08.org>

24th Biennial Symposium on Communications (QBSC)

2008-06-24...26, Kingston, ON
<http://www.ece.queensu.ca/symposium/>

IEEE Int'l Symposium on Information Theory (ISIT)

2008-07-06...11, Toronto, ON
<http://www.isit2008.org>

EAST ...

6th Annual Communication Networks and Services Research Conference (CNSR)

2008-05-05...08, Halifax, NS
<http://www.cnsr.info/Events/CNSR2008/>

IEEE Int'l Workshop on Medical Measurement and Applications (MeMeA)

2008-05-09...10, Ottawa, ON
<http://www.sermis.polito.it/memea/>

Joint IEEE North-East Workshop on Circuits and Systems and TAISA Conference (NEWCAS-TAISA 2008)

2008-06-22...25, Montréal, QC
<http://www.newcas.org>

9th Int'l Conference On Intelligent Tutoring Systems (ITS)

2008-06-23...27, Montréal, QC
<http://gdac.dinfo.uqam.ca/its2008/>

IEEE Int'l Symposium on Technology and Society (ISTAS)

2008-06-26...28, Fredericton, NB
<http://istas08.ca/>

IEEE Int'l Professional Communication Conference (IPCC)

2008-07-13...16, Montréal, QC
<http://ewh.ieee.org/soc/pcs/index.php?q=node/2>

2nd Int'l Conference on Wireless on Communications in Underground and Confined Areas (ICWCUCA)

2008-08-25...27, Val d'Or, QC
<http://www.icwcuca.ca>

OCEANS 2008

2008-09-15...18, Québec, QC
<http://www.oceans08mteeequebec.org/>

IEEE Sections Congress

2008-09-19...22, Québec, QC
<http://www.ieee.org/sc2008>

33rd IEEE Conference on Local Computer Networks (LCN)

2008-10-20...23, Montréal, QC
<http://www.ieeelcn.org/>

IEEE Electrical Insulation Conference (EIC)

2009-05-31...06-04, Montréal, QC

22nd IEEE Canadian Conference on Electrical and Computer Engineering (CCECE-CCGEI)

2009-05-03...06, St. John's, NFLD
<http://www.ccece09.org>