IEEE
VANCOUVER
CANADA

JUNE 2008
VOLUME 38
NUMBER 01

CONTACT
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

Power and Energy

Sustainable Opportunities for the Clean Energy Sector

Walter V. Cicha
NRC-CISTI
Thursday 19 June Noon-1:00pm
Centre Room of BC Hydro Edmonds Auditorium, 6911 Southpoint Drive, Burnaby (Edmonds Skytrain Station)

The price of oil is not likely to fall below $100 per barrel in the foreseeable future. Capitalizing on this business opportunity, developers of the Alberta oil sands face the daunting challenge of controlling increasingly high levels of greenhouse gas (GHG) emissions resulting from the inefficient and energy intensive process of "mining oil." Meanwhile, the government of British Columbia earlier this year became the first in North America to place a tax on GHG emissions, and also has invested $95 million into establishing the Pacific Institute for Climate Solutions. This presentation will address how development of new technology and optimization of traditional industrial processes must complement such government initiatives to become an integral component in addressing the global economic and humanistic challenges of an increasingly industrialized and growing population, which is rapidly driving up demands for low-cost and sustainable energy. In North America, the clean technology sector (predominantly concerned with clean energy generation) is already privy to > $ 3 billion annually in private investment, but this is only ~ 0.1 % of the global energy industry's total value. There is seemingly much opportunity here for growth. A systemic vision will be offered in this presentation, focusing on energy challenges and potential solutions of relevance to British Columbia, Canada and the world.

Speaker: Dr. Cicha earned his Ph.D. in Chemistry form UBC in 1989. After a one year Postdoctoral Fellowship at CE Saclay (France), he spent two years with the Cameco Corporation in Saskatoon, SK developing novel laser isotope enrichment technology. In late 1992, he commenced as Senior Chemist at the Experimental Station of the DuPont Company, in Wilmington, DE, U.S.A. He discovered a new nanostructured carbon catalyst for phosgene production in 1994 that was put into commercial production at Dupont's Nomex and Kevlar polymer plant the following year. Dr. Cicha and his team were recipients of the American Chemical Society's 1997 Hero of Chemistry award for the exceptional environmental engineering value of this work. From 2000 until the beginning of 2005, Dr. Cicha was involved as Senior Scientist with diverse efforts at General Electric's Global Research Center in Schenectady, NY, U.S.A. and Carbon Nanoprobes (Seattle, WA, U.S.A). Throughout 2007, Dr. Cicha served as Clean Energy Technology Advisor for the BC Nanotechnology Alliance (Nanotech BC), before joining the National Research Council in Vancouver in 2007 as Technical Business Analyst responsible for the Canadian hydrogen and fuel cell cluster. Dr. Cicha is the holder of 11 issued patents and the author or co-author of > 60 publications, spanning a variety of technical and general topics.

Joint Communications

Powerline Communication Systems

Mr. Sam Shi - CTO
Corinex Communications Corp.
Monday 09 June 700 - 900pm
BCIT SW3-1750

Technologies of power line communications (PLC) were developed almost one hundred years ago along with the power industry. However, high-speed data (14Mbps to 200Mbps) communication, i.e., Broadband Power Line (BPL), as a part of Internet access merged just a couple of years. In the presentation we'll focus on the following parts:

- Physical characteristics of power line grid;
- Electricity grid is a dynamic system due to changeable impedance, loads and noise.
- OFDM (Orthogonal frequency-division multiplexing) and DSP technology;
- Able to cope with problems commonly exited on power line: multipath, narrowband interference, high frequency-attenuation, frequency-selective fading.

Home-broadband applications:
Inthernet access distribution, HDTV signal transmissin, VoIP and appliance-control. Advantages and disadvantages comparision with wireless.
Utility applications:
Tranditional power-grid control: metering and control. "Green-power-grid" trial by IBM Central-point and Corinex.

Networking features of BPL devices:
VLAN, SNMP, FTP, 802.1D, 802.1Q VLAN, MAC filtering, MAC&QoS, TCP/IPv4, TFTP, DHCP
UPA (DS2) and Home Plug Powerline Alliance (Intellon)
Two main R&D organizations in BPL.
DS2: DSS9001, 9002, 9003;
Intellon: INT6000, INT63000

Challenges: EMC, anti-noise

Speaker: Sam Shi is the CTO for Corinex Communications and is responsible for Research and Development and Product Development. He has been with the company for 4 years and was one of the first employees of the company.
Prior to joining Corinex, Mr. Shi worked in various senior development capacitiesin the telecom industry for companies including Telos and UT Starcom. As a member of Corinex's executive team for 4 years and a board member, Mr. Shi has helped build the company into the market leader in the Powerlineindustry.
He was instrumental in developing award winning Powerline products and filing of 4 patents for the industry. Mr. Shi holds a degree in Computer Science and Business from Simon Fraser University, British Columbia.
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Info: For more information on upcoming events for the Vancouver Chapter of the IEEE PES, please visit our web page http://ewh.ieee.org/reg/7/vancouver/powereng/
or contact the Chapter Chair, Glen Tang, by e-mail at glen.tang@powerex.com
or Mahta Boozari at mahta.boozari@bchydro.com

Circuits and Systems

Fast, Efficient & Practical Algorithms for Compressed Sensing

Dr. Trac D. Tran
The Johns Hopkins University
Thursday 22 May - 3:00 pm to 4:00 pm
Room 10041, Building ASSC-1
Simon Fraser University, Burnaby
Webcast information
http://www.ensc.sfu.ca/~jiel/ieee/008_Tran.html

In the conventional uniform sampling framework, the Shannon/Nyquist theorem tells us to sample a signal at a rate at least two times faster than its bandwidth for the original signal to be perfectly reconstructed from its samples. Recently, compressed sensing has emerged as a revolutionary signal sampling paradigm which shows that Shannon theorem is indeed overly pessimistic for signals with a high degree of sparsity or compressibility.

The compressed sensing framework demonstrates that a small number of random linear projections, called measurements, contains sufficient information for signal reconstruction, even exactly. The two key components of compressed sensing are: (i) the sensing matrix at the encoder must be highly incoherent with the sparsifying signal transformation; and (ii) sophisticated non-linear algorithms such as basis pursuit or orthogonal matching pursuit are employed at the decoder to recover the sparsest signal from the received measurements.
The first part of this talk gives an overview of the new compressed sensing framework along with the most elegant breakthrough results in the field. The second part focuses on two recent compressed sensing discoveries from the JHU Digital Signal Processing Lab. Particularly, a fast and efficient sampling algorithm for compressed sensing based on structurally random matrices will be presented. Our proposed sampling scheme provides several crucial features for practical implementation: fast computable, memory efficient, streaming capable, and hardware friendly while retaining comparable theoretical performance bounds with current state-of-the-art techniques.
Secondly, at the decoder side, we present a novel iterative reconstruction algorithm for compressed sensing called Generalized Orthogonal Matching Pursuit (GOMP) that can adaptively, at each iteration step, admit new atoms to join the current selected set from a small candidate set while discard from the selected set atoms that might be highly regarded in previous steps. Simulation results show that GOMP's performance far exceeds the best existing iterative algorithms with reasonable complexity overhead. Finally, future research directions in compressed sensing are also discussed if time permits.

Speaker: Trac D. Tran received the B.S. and M.S. degrees from the Massachusetts Institute of Technology, Cambridge, in 1993 and 1994, respectively, and the Ph.D. degree from the University of Wisconsin, Madison, in 1998, all in Electrical Engineering.
In July of 1998, Dr. Tran joined the Department of Electrical and Computer Engineering, The Johns Hopkins University, Baltimore, MD, where he currently holds the rank of Associate Professor. His research interests are in the field of digital signal processing, particularly in sampling, multi-rate systems, filter banks, transforms, wavelets, and their applications in signal analysis, compression, processing, and communications. He was the co-director (with Prof. J. L. Prince) of the 33rd Annual Conference on Information Sciences and Systems (CISS'99), Baltimore, MD, in March 1999. In the summer of 2002, he was an ASEE/ONR Summer Faculty Research Fellow at the Naval Air Warfare Center – Weapons Division (NAWCWD) at China Lake, California. He has served as Associate Editor of the IEEE Transactions on Signal Processing as well as IEEE Transactions on Image Processing. He currently serves as a member of the IEEE Technical Committee on Signal Processing Theory & Methods.
Dr. Tran received the NSF CAREER award in 2001 and the William H. Huggins Excellence in Teaching Award from Johns Hopkins University in 2007.

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Electron Devices

Reliability of High-k Gate Dielectrics in sub-45nm CMOS Devices

Dr. Durga Misra
New Jersey Institute of Technology
EDS Distinguished Lecturer
Friday 23 May - 2:00pm
ASB 9896 - SFU Campus

Stringent power requirements in the chips by the International Technology Roadmap for Semiconductors (ITRS) dictate replacement of silicon dioxide as it has already reached the direct tunneling regime. Therefore, for high speed and low power applications high-k dielectric materials are being integrated into standard CMOS technologies. At present, reliability requirements of advanced gate stacks with high-k dielectrics are of intensive research interests as these high-k dielectrics needs to meet the silicon dioxide standards. In this talk some of the on-going research work on charge trapping in high-k dielectrics such as HfO2 and HfSixOy will be discussed in detail. Detection mechanism of electrically active intrinsic traps will be outlined. Based on the negative bias temperature instability (NBTI) the results will be correlated with theoretical models. Breakdown measurements of HfO2 and HfSixO will be discussed with respect to poly and metal gates, as will High-k on alternate substrates like Ge substrate.

Speaker: Dr. Durga Misra is a Professor in the Department of Electrical and Computer Engineering of New Jersey Institute of Technology (NJIT). He received his M.S. and Ph.D. degrees both in Electrical Engineering from University of Waterloo, Waterloo, Canada in 1985 and 1988 respectively. He has been a faculty member since the fall of 1988 at NJIT. His current research focus is study of nanoscale CMOS gate stacks. He received several research awards from the National Science Foundation and Industry. In 1997 he worked at the VLSI Research Department at Bell Laboratories of Lucent Technologies. He received IEEE Regional Activities Board's International Leadership Award and is currently a Distinguished Lecturer of Electron Device Society of IEEE. He has organized many International Symposiums on Solid-State Science and Technology field during the Technical Meetings of the Electrochemical Society and IEEE. He served as the Chairman of North Jersey Section of IEEE during 2003 and 2004. Currently he serves as the EDS-SRC Chair for Regions 1-3 & 7 of IEEE. He is also a Fellow of the Electrochemical Society.
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