



IEEE Canada



KITCHENER-WATERLOO SECTION

January 2006

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The Kitchener-Waterloo Section of the Institute of Electrical and Electronics Engineers serves members whose mailing address is in Bruce, Grey, Perth, Waterloo or Wellington counties. It collects news relevant to local engineers and is published bi-monthly.

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Upcoming Events

Check <http://kw.ieee.ca/activities.html> for updated information.

Ultra-Wideband Communications for sensor networks

IEEE Vehicular Technology Chapter Presentation

Dr. Andy Molisch of Mitsubishi Electric Research Labs, and Lund University

February 2, 11:00 am – 12:00 noon, DC 1302, University of Waterloo

Ultra-wideband (UWB) communications is an extremely promising technology for sensor networks with low (≤ 1 MBit/s) data rate. UWB offers high robustness to fading, low energy consumption, and the possibility for very precise geolocation. Recognizing these advantages, the IEEE has established a task group 802.15.4a that during the past 2 years developed a standard for such low-rate UWB devices. This standard, which covers both the PHY and the MAC layer, will be the main topic of this talk. It contains a number of scientific innovations that specifically exploit the sensor network applications. The physical layer is based on impulse radio, using bursts of impulses that allow coherent as well as noncoherent detection. Good spectral properties are obtained by polarization scrambling. Further options allow the use of chaotic waveforms or chirping. On the MAC side, pure ALOHA, or a special form of CSMA are used, and provisions are made for ranging that is resistant to spoofing or interception. The talk will wrap up with a description of possible applications and networking considerations.

HDTV Development and Future/Annual General Meeting

Feb 20, Dearborn Restaurant, 105 Lexington Road, Waterloo

Brian James will discuss the development and challenges in creating the North American standard for High Definition Television as well as what the next few years will bring as this standard is adopted.

Choices of menu \$25/person, and cash bar

RSVP by Feb 13 to ardalan@ieee.org for reservations

Student Fair Judges Needed

April 4, Bingemans, Kitchener

The Waterloo-Wellington Science and Engineering Fair is looking for judges. No previous experience required though judges should be familiar with scientific methods and be interested in talking to young, enthusiastic minds.

For information on the event see:

<http://www.science.uwaterloo.ca/WWSEF/wwsefr1.htm>

To signup contact:

Reggie Lo rlo@uoguelph.ca

Robotics competition returns to UW

UW Media

Some of Ontario's brightest high school students will once again converge on the University of Waterloo campus for the FIRST Robotics Waterloo Regional Competition this spring. The FIRST (For Inspiration and Recognition of Science and Technology) Robotics regional competition at Waterloo will take place March 23-25.

The contest involves short games played by remote-controlled robots which are designed and built within six weeks out of a common set of basic parts by a team of 15 to 25 students and a handful of engineer-mentors. The students pilot the robots on the field.

The event is called "an exciting, multinational competition that teams professionals and young people to solve an engineering design problem in an intense and competitive way." The regional competitions are high-tech spectator sporting events, the result of focused brainstorming, real-world teamwork, dedicated mentoring, project timelines and deadlines.

<http://www.firstrobotics.uwaterloo.ca/>

Chapters Need Volunteers to Form

The IEEE KW section continues to grow with the membership showing a wide range of interests. The societies listed below have sufficient interest to form a local chapter. The chapters arrange speakers and administer funding. There is a criteria for forming one of these chapters, so if you are a society member or plan to be a member and are interested

in volunteering to startup a local Section Society chapter, please let us know at ieee_kw@ece.uwaterloo.ca

- Engineering in Medicine & Biology
- Engineering Management
- Geosciences & Remote Sensing
- Product Safety Engineering
- Professional Communication
- Society on Social Implications of Technology

Recent Events

Senior Member Upgrades

The following local member has earned the professional recognition of peers for technical and professional excellence.

Dr. Ellsworth LeDrew (Fellow)

See <http://www.ieee.org/ra/md/smprogram.html> for more information on this program.

Neural Networks for RF and Microwave Design

IEEE MTT presentation by Q.J. Zhang, Carleton University, Ottawa, Canada

Significant advances continue in modeling and CAD to meet the challenges of next generation high-frequency electronic design. Increasing design complexity, coupled with tighter component tolerances and shorter design cycles, demand tools that are faster, more accurate and automated than possible today. It becomes important to achieve EM/physics-based design accuracies not only at the component level, but also at the circuit and system levels. Recent advances in the application of Artificial Neural Networks (ANN) to RF/microwave design created an exciting direction of computer-aided modeling for passive and active devices at component and circuit levels. It leads to substantial increase in modeling accuracy, speed, and flexibility. Applications are being made in modeling and design of microstrip and CPW circuits, multilayer interconnects, embedded passives, printed antennas, LTCC circuits, semiconductor devices, measurement standards, filters, amplifiers, mixers and so on. Knowledge based engineering concepts exploiting prior design knowledge are being introduced in microwave CAD such as knowledge-based neural networks, and knowledge-aided design. This leads to new level of CAD methodologies combining equivalent circuit/empirical models, EM/physics simulation and behavioral modeling with ANN and optimization algorithms for fast and accurate design of RF/microwave circuits and systems.

This talk presents a review of the state of the art in these emerging directions. The presentations highlight implementable methodologies for automated modeling and design of high-frequency electronic components, circuits and systems. The presentation covers fundamental concepts and methodologies, industrial applications, and future trends in R&D.

Robotic Based Microassembly of 3D MEMS Structures

IEEE MTT presentation by N. Dechev University of Victoria

This seminar described a novel microassembly system that can be used to construct 3D Micro Electromechanical Systems (MEMS) from a set of sub-millimeter micro-parts. Four novel approaches have helped to create one of the first microassembly systems that can consistently grasp, join and release surface micromachined MEMS parts. The microgrippers of this system are currently the smallest size in use, and the micro-parts used are as small as 70 um by 70 um by 5 um thick

Ionospheric Effects on HFSWR Performance

IEEE AESS presentation Dr. Ryan Riddolls, DRDC Ottawa

Canada currently operates two High Frequency Surface Wave Radar (HFSWR) systems. These radars can detect, locate, and track ocean vessels beyond the Earth's horizon by taking advantage of the diffraction of electromagnetic waves over the conducting ocean surface. However, long-range ocean vessel detection is confounded by radar clutter comprising echoes from the ionospheric plasma. In this presentation we examine the physics of these echoes, recognizing that the ionosphere is an inhomogeneous, anisotropic, nonlinear medium.

RF MEMS For Commercial and Defense Applications

IEEE MTT Presentation by G.M Rebeiz, U of California

The development of RF MEMS switches has accelerated considerably over the past several years and currently there are several switches which have been tested to 100 billion cycles with no failures. This talk presented the latest work in high isolation switch networks, phase shifters, and tunable filters.

Network Control Plane for the Grid Community - What Has Changed?

IEEE co-sponsored presentation by Dr. Admela Jukan of Polytechnic of Milan, Italy

E-science applications present a new challenge for networks, as they require the high bandwidth connectivity to support leadership class Supercomputers (teraflops+) and, at the same time, highly dynamic operation enabled through Grid computing today. Significant research activity has been carried out to meet this challenge and, in particular, in understanding how to provision and use high capacity connections in networks below the IP layer, such as in optical networks. In contrast to the common belief, however, the use of high-capacity networks is not about installing fibers between remote research centers; instead, it is how these connections are accessed and utilized by the driving applications. This presentation will address the new evolving paradigms for network control plane and will argue that the majority of issues related to networking have changed: from architecture, over the role of users and resources, to network services.

BioMedical Image Analysis: From microscopical to human scales

IEEE presentation by Aurélio Campilho Biomedical Engineering Institute.

University of Porto, Portugal

Image Analysis is playing an important role in Biology and Medicine, helping the scientists to develop new ways to study living specimens or acting as a medical tool for computer aided diagnosis. This talk will address two applications: a biological problem,

for automatic tracking of a moving root in confocal microscopy; and a computer aided diagnosis approach, for detecting lung nodules in X-ray images. These applications different in nature, scope, purpose, and image dimensions, illustrate the Image Analysis capabilities, limitations and challenges in Biology and Medicine.

MIMO Communications In The Real World

IEEE co-sponsored presentation by Dr. Tricia Willink Communication Research Centre

Current MIMO research at CRC focuses on MIMO techniques that operate in real propagation environments or address the problems that arise in practical systems.. In this presentation, the performance of different MIMO techniques will be evaluated using measurement data obtained with the CRC MIMO testbed, and some of the issues that face real MIMO communication systems will be discussed. A case study using eigenbeamforming will be presented, demonstrating the use of MIMO in an unconventional application and illustrating its limitations.

Interaction of Rate Control and Medium Access Control in Wireless Networks

IEEE co-sponsored presentation by Dr. Peter Marbach, University of Toronto

We consider the interaction between rate control and medium access control in wireless networks. The work is motivated experimental studies on the interaction between TCP rate control and IEEE 802.11 medium access control which have shown that this combination has several drawbacks. For example, it has been shown that the throughput deteriorates as the number of active nodes increases. We first develop a simple model which allows us to study and explain this behavior. We then develop an alternative rate and medium access control scheme which leads to improved performance in terms of system throughput and fairness.

Prof. Andersson's Visions of Future Energy Networks

Tom East

At a University of Waterloo Department of Electrical and Computer Engineering seminar on 8th December, Prof. Goran Andersson described work going on at his group in the ETH at Zurich, Switzerland. With sponsorship from several electricity companies (who expect him to look 30 years into the future), he is starting from the demand side to see what energy consumers need and how these needs could be met, ignoring the existing generating and distributing system.

His group has produced computer models of possible networks for connecting sources to sinks, and generated optimum configurations. The energy flows considered include natural gas and hydrogen as well as electricity. One possibility was a gas pipeline with a conductor in the middle carrying electric power: not likely to be a favoured method!

In Switzerland, many workers go home at noon for a cooked lunch: this puts a peak demand at the noon hour. Many new houses (including the professor's) have a timer which disables the dishwasher and washing machine at this time each day.

Jay Ingram Asked “Are You Conscious?”

Tom East

At the Perimeter Institute public lecture on January 4th, Jay Ingram, writer and broadcaster (on the Discovery Channel) discussed consciousness under the above title. Some scientists say it must be subjective, therefore not scientific, but others disagree. While we are awake, we all receive data through our senses, and in processing this data, assigning it to memory, analyzing it, deciding on action and acting on it are all conscious actions.

The speaker pointed out that many experiments have shown that being conscious is not straightforward, and is sometimes puzzling. The audience were all sitting on chairs, but almost all would not be conscious of the pressure of the seat on the bum unless it was mentioned. He showed us a picture of Canadian peacekeepers entering a large aircraft, then showed a second picture which seemed to be identical, until it was pointed out to us that an engine nacelle was present in one picture but not in the other.

Many “optical illusions” demonstrate that visual data is not processed in a straightforward way. In one experiment, two disks which were actually identical appeared to have different diameters because of different surroundings, yet when a subject was asked to pick them up, identical finger spacings were used to grip them.

In a psychology experiment (typical because the subjects were misled as to the true nature of the test!), one group of volunteers was given a list of words which would be associated with old age, and a control group, words without such connotation, and given some task. The subjects were dismissed, but timed leaving the room, and the first group walked more slowly than the second.

Ingram described many examples in which the subconscious seemed to contain ample data which was only used selectively by the conscious mind.

There is such a thing as “childhood amnesia” – we cannot describe anything that happened to us before 3 years old – though a New Zealand experiment showed that an experience that occurred at 2 years old could be described by 3 year olds, but only in baby talk.

The audience (a full house as usual) followed the talk enthusiastically for a full hour, and then asked many questions.

The Perimeter Institute public lectures are held on the first Wednesday of each month (except in summer), and are broadcast later in the month on cable channel 20 in Waterloo Region and Guelph.

Climate Bubble Earns Second Place

UW Media

University of Waterloo engineering student Kirsten Robinson took second place in the Design for the Cold Competition with a plan to cover sections of northern downtowns with innovative transparent materials

The entry, called the "Sudbury Street Skins Project," imagines ecologically friendly solutions for downtown spaces in northern cities. It proposes covering streets with a transparent roof made of an ecologically friendly material called Texlon. The "Street Skin" would hold in heat, creating a "micro-climate" that would be comfortable throughout the year.

http://alumni.uwaterloo.ca/alumni/e-newsletter/2005/december/second_third.html

UW Design Symposium

various

The 4th year E&CE students presented their design projects in January. The projects cover a wide range and introduce a number of novel approaches.

The abstracts are available at:

<http://eceprojects.uwaterloo.ca/www/abstracts/2006>

Waterloo Finalist in Intelligent Community

UW Daily Bulletin

Waterloo joins 6 other communities from around the world on the list of communities being considered as the Intelligent Community of the Year, an honour that recognizes the community that best exemplifies the development of a prosperous economy based on broadband and information technology.

Waterloo's nomination credits its universities, hospitals, libraries and schools as well as companies such as RIM, Open Text, Sybase, iAnywhere and Manulife that export their products, technology and services around the world. It also notes the Perimeter Institute for Theoretical Physics, the Centre for International Governance Innovation, UW's Institute for Quantum Computing and Research and Technology Park, and the presence of Communitex and Canada's Technology Triangle as being further reflections of leadership as an intelligent community.

<http://www.intelligentcommunity.org/>

Agile Systems Upgrades Stepper Motor Control

Waterloo Tech Digest

Agile Systems unveiled its new SilentStep technology, which it says can double motor speeds and reduce energy demand by taking basic stepper motors used in such applications as printers, photocopiers, and packaging and lab automation equipment and converting them into high-performance servo-motors.

http://www.agile-systems.com/pdfs/News/Agile_PR_SILENTstep_11_2005.pdf

Canadian Engineering Competition

UW Daily Bulletin

UW was successful in its recent bid to host the 2008 Canadian Engineering Competition, which attracts top engineering students from across the country, says a news release from UW's media relations office. A UW committee won the event at the recent annual congress of the Canadian Federation of Engineering Students. The CEC is an annual event that includes competitions in both technical and socially based areas. "The Canadian Engineering Competition is the culmination of engineering competitions across Canada," said Brandon Malleck, a leader of the bid committee on behalf of the student Engineering Society. Through six competitions, students are challenged to demonstrate their skills in communication, leadership, teamwork and design. Competitors must prepare a written report detailing their solution and make a presentation or demonstration before a panel of experts from industry and academia.

Funds for Sight and Touch Studies

UW Daily Bulletin

Two Waterloo graduate students working in the field of robotics and intelligent systems have been awarded scholarships by Ottawa-based Precarn Incorporated.

Hao Xin's scholarship will assist her research in "Tactile Feedback for Robotic Surgery". Adel Fakhri's research will focus on "Seeing Depth with a Single Camera".

Prof Leads New Remote Sensing Project

UW Daily Bulletin

A Waterloo engineering professor leads a team that has won a highly competitive national award to pursue research on remote sensing and computer vision technologies in order to better identify sea ice.

David Clausi of systems design engineering has been awarded two-year grant as part of the Strategic Investment Initiative from the NSERC Network of Centres of Excellence called GEOIDE (Geomatics for Informed Decisions).

Clausi's project, "Classification of Operational SAR Sea Ice Imagery," was one of eight selected from an initial pool of 53 projects. "The funding will allow me to continue working on what has been referred to as the 'holy grail' of remote sensing and computer vision technologies, namely, the ability to automatically identify open water and specific ice types in radar-based satellite imagery," said Clausi, whose research interests include computer vision, digital image processing and pattern recognition.

Quantum Step Forward

UW Daily Bulletin

Researchers from UW's Institute for Quantum Computing have taken a major step forward in finding out how to make quantum information processing devices more powerful than today's computers.

The paper in the prominent international journal, titled "A Spin-Based Heat Engine: Experimental Implementation of Heat-Bath Algorithmic Cooling," was written by IQC

members Jonathan Baugh, Osama Moussa, Colm Ryan, Ashwin Nayak and Raymond Laflamme. It discusses how quantum computing seeks to utilize the laws that govern microscopic objects such as atoms and molecules -- quantum mechanics -- to make information processing devices fundamentally more powerful than currently available computers.

The work describes the implementation of a powerful form of cooling, called heat-bath algorithmic cooling, in a solid-state nuclear spin system. It is a high-precision demonstration of this technique in a promising quantum information processing system.

Hydrogen Powers Resurfacing Machine

KW Record

Elmira firm, Resurface Corp. has produced an ice resurfacing machine (Zamboni) based on hydrogen fuel cells. Short-distance indoor vehicles are an excellent usage of hydrogen power because there are no emissions and the hydrogen can be delivered onsite.

LiveHive Starts Selling Betting System

KW Record

Local startup company LiveHive is using local funding and resources to make a big push into the global online betting pool. Their product allows real-time bets to be placed on micro-events (the next play within a game) and on non-traditional topics such as Survivor.

Sirific Wireless Compresses Cellphone Electronics

KW Record

Sirific's new chip handles all the radio signals in a cellphone and is only 7mm square. It is being tested by major cellphone manufacturers and looks like it could take the company from a pre-revenue startup to a going concern.

Engineers and the World

Earth Rangers Optimize Building

Globe and Mail

The Earth Rangers Centre, in Woodbridge near Toronto is one of Canada's greenest buildings. Designed by German architects, it uses many techniques to reduce power and resource usage. This includes moderating fresh air by having it enter thru buried pipes, recycling water within the building and using solar energy.

Miriam Shuchman on Whistleblowing

Tom East

There was a good turnout for the Perimeter Institute public lecture on December 7th (though not the usual full house). The title of the lecture was "The drug trial: You be the judge." The speaker was Dr. Miriam Shuchman and her talk was based on her recently published book.

In the pharmaceutical industry, whistle blowing usually takes the form of an employee, or someone working under contract, going public (through the media or otherwise) about dangerous side effects of a drug which is being promoted by the company. The whistleblower would normally have tried to make his or her case internally first. The problem is that they have signed an agreement not to disclose information outside the company.

The company will usually fight back, because of harm to its reputation and of course financial loss, through legal means or by casting aspersions on the complainer's qualifications or motives. The effect on the whistleblower can be devastating: either having to leave that type of work, or even in one case mentioned, suicide.

Dr. Shuchman stated that many "whistleblowers" are motivated by malice, pique or revenge. Only about 25% are genuine.

The talk was followed by a lively question and answer session. Some speakers seemed to be making prepared statements, and some challenged statements in her book, which she defended.

The book "the Drug Trial" is available at Words Worth Books in Waterloo.

Trends Likely to Affect Us All in 2006

IEEE-USA

WASHINGTON (13 January 2006) -- Changes and trends in eight major areas likely to affect how we live, work and play are examined in the latest issue of IEEE-USA Today's Engineer Online.

In "What Lies Ahead: Forecast for 2006," Today's Engineer author George McClure examines technology, energy, climate change, work force, employment benefits, immigration, infrastructure and the economy. McClure, a noted expert on technology careers and retirement benefits, looks at where things are today and where they're likely headed. A sampling:

- The United States has the lowest savings rate among developed nations, implying a lack of savings for retirement and children's college costs. McClure points out the trend of greater consumer spending than consumer income "works for only so long, and will cease to be a source of consumption funding as interest rates rise to combat inflation."
- Significant upgrades are needed to repair the United States' crumbling infrastructure, including \$50 billion to improve the national power grid over the next five years. "As power demand increases by 50 percent in 20 years," McClure writes in Today's Engineer, "so will the problem of getting it to the user, as well as the prospect for further blackouts, if reliability is not improved."

The full article is available at: <http://www.todaysengineer.org/2006/Jan/forecast.asp>

NanoTech at IEEE Virtual Museum

IEEE

The IEEE History Center is proud to announce the launch of the newest exhibit on the IEEE Virtual Museum (VM): "Small is Big: The Coming Nanotechnology Revolution." It can be accessed directly at

<http://www.ieee-virtual-museum.org/exhibit/exhibit.php?id=159272&lid=1>

Engineering Humour

Selected by Tom East

The Music Competition

A member of the BBC Symphony Orchestra was travelling on a train in England when a young man carrying a portable radio sat near him and turned on a rock and roll station very loud. The musician asked him to turn it off. "Why should I?" said the young man. "This is a free country."

The musician replied "So it is – of course you're right." He stood up, reached into the overhead luggage rack, fetched down a french horn and proceeded to assemble it, ready to start playing...