IEEE NEWSLETTER
KITCHENER - WATERLOO SECTION

February 1992

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The Kitchener-Waterloo Section of the Institute of Electrical and Electronics Engineers serves all members whose mailing address is in Bruce, Grey, Waterloo or Wellington Counties.

Contents

Meetings

Feature Articles

Presented by: K-W Section
March 11 - Video Lecture - Thurow on Competitiveness

Date: Wednesday, March 11th, 1992
Time: 7:30 pm
Place: University of Waterloo
Davis Centre, Room 1302

Subject: Maintaining Our Competitiveness In A Changing World
Speaker: Dr. Lester Thurow is Dean of Economics at the Massachussetts Institute of Technology, Cambridge, Mass., U.S.A.
Topic: The video presents the global challenge which the USA faces. Many of the aspects discussed are relevant to the Canadian experience. This presentation, made in 1991 to an international conference, is well paced and entertaining. It will be of great interest to anyone concerned about our economic future.

March 23 - Student Papers Night

Presented by: K-W Section; Student Branch A, University of Waterloo; and Student Branch, Conestoga College.
Date: Monday, March 23, 1992
Time: 5:30 pm
Place: Golf's Steak House, 598 Lancaster St.,
Cash Bar at 5:30 p.m.
Dinner at 6:15 p.m.
Student Papers Competitions at 7:15 p.m.

Cost: IEEE members and others $18.00
Students and their guests $9.00

Contact for tickets:

Ed Spike	885-1211 Ext. 3716
Li Deng	885-1211 Ext. 6041
Tim Williams	748-5220 Ext. 271
Deborah Stacey	824-4120 Ext. 2634

You are cordially invited to the annual Student Papers Night. Following a cash bar and a delicious dinner, students from Conestoga College and from the University of Waterloo, will deliver oral presentations of their technical papers. The best paper from the College is awarded the Ken McKenzie Award and the best paper from the University receives the George Dufault Award: the awards include cash prizes.

To reach Golf's Steak House, take the Conestoga Parkway, exit at Bridgeport Road (East), turn left at traffic lights and look for steeply rising driveway on the right.

Presented by: K-W Section
March 30 - Amateur Pocket Radio-Hams using Ax25 and TCP/IP

Date: Monday, March 30, 1992

Time: 7:00 p.m.

Place: University of Waterloo
Davis Centre, Room 1304

Speakers: Roger Sanderson-VE3RKS, Ed Spike-VE3TCK, and Ralph Korchensky-VE3EUK

Topic: Amateur Radio Operators are now connected via an electronic mail and bulletin board system using Packet Radio

Demonstration: Send a message to a friend. Find out the call sign of a ham close to your friend's house and bring it to the meeting.

April 7 - J.J. Yang on: Ground Resistance Measurement
Presented by: Microwave Chapter

Date: Tuesday, April 7, 1992

Place: University of Waterloo
Davice Centre, Room 1304

Time: 7:00 p.m.

Speaker: J.J. Yang, Department of Electrical & Computer Engineering,
University of Waterloo

Subject: Grounding resistance of buried electrodes in multilayer earth is predicted by simple voltage measurements along earth surface. The earth is modelled as an inhomogeneous conducting medium with multiple horizontal layers. Equivalent images are determined by voltage measurements along the earth's surface. The images are applied to compute underground voltage profiles and to predict the grounding resistance of buried electrodes.

CONFERENCES IN CANADA

March 8-15	Engineering Week - Toronto
March 25-28	INCOM 92 - Toronto
May 5-6	High Technology Show - Toronto
June 3-4	Electrotech West - Vancouver

June 14-18 Electrotech 92 - Montreal

Sept. 13-16 Canadian Conference on Electrical and Computer Engineering (CSECE 92) - Toronto
Call for papers deadline: March 15

October 7-9 6th Signal Processing Workshop - Statistical Signal and Array Processing - Victoria

FUSION: Energy for the Future
By Tom East

We are all aware that much of our electrical energy comes from fission of uranium into smaller atoms, with its well known advantages and drawbacks. For many years, a number of laboratories have been working on the fusion of hydrogen into larger atoms, which also releases large amounts of energy. To celebrate a major European breakthrough in November last year, a public meeting was held at the Ontario Science Centre on January 23rd 1992, sponsored by:

Institution of Electrical Engineers (UK) Toronto Overseas Centre
IEEE Canada
Ontario Science Centre
Consulting Engineers of Ontario
Association of Professional Engineers of Ontario
Royal Canadian Institute

Confinement

The claims of cold fusion have not achieved wide recognition and almost everyone now agrees that useful amounts of energy can only be obtained by raising the light elements (preferably deuterium and tritium, isotopes of hydrogen) to extremely high temperatures and preventing them from blowing apart. The two ways of doing this are Inertial Confinement (using high power lasers) and Magnetic Confinement in a structure such a a Tokamak (Russian acronym for toroidal magnetic chamber). "Tokamaks are about ten years ahead" according to one speaker. A typical Tokamak contains a doughnut-shaped vacuum chamber (torus) in which the fuel becomes a plasma. The torus is enclosed in a complex magnetic system to keep the plasma from touching the walls. For short pulse experiments the torus becomes a shorted turn of a transformer, but for longer pulses microwave heating must be used.

The world's large Tokamak projects are;

Europe	JET	Culham, UK
USA	TFTR	Princeton U
Japan	JT-60	Naka
USSR	T-15	Moscow

They cost roughly a billion dollars each.
Each of the above groups plans a Next Step machine to handle larger amounts of power. There are about 30 smaller advanced Tokamaks including the Tokamak de Varennes near Montreal. Canada supplies engineered fusion equipment to several European sites.

JET

The Joint European Torus is a collaborative European Community project based at Abingdon, Oxfordshire, UK. (Several Canadian scientists are on the team). It is the world's largest fusion device. The torus is several metres in diameter and 4 metres high.

On November 9th, 1991, about 200 milligrams of deuterium and tritium gas was heated to a temperature of around 200 million degrees Celsius - nearly ten times hotter than the centre of the sun. The peak fusion power generated reached almost 2 MW: the pulse lasted 2 seconds and the total energy released was 2 megajoules. The significant feature of this trial was that the heat generated equalled the energy put in - the break-even point. Of course, much of the heat escaped. In a larger machine, enough heat would be retained that the reaction would be self-sustaining- "we have ignition" - and the heating source would be turned off.

ITER

The four competitors listed above have combined to work on the International Thermonuclear Experimental Reactor, which will have about twice the linear dimensions of JET and is expected to achieve ignition, a self sustained reaction, for long periods. It will use superconducting coils.

Canada is part of the European team. This project went through basic design in 1988-90: detailed engineering design 1991-96. The next stage will be to choose a city to host the reactor. Necessary qualifications include a good connection to a power grid, water, land and the ability to house and feed a large group of scientists and engineers in the style to which they have become accustomed. It was agreed initially (during the cold war) that it should not be placed in the USA or the USSR. Construction is scheduled for 1996-2004.

Fusion Canada

Canada has the largest deuterium output in the world, and the largest tritium output in the non-military world. Tritium is a by-product of CANDU: Darlington produces 3kg per year. (It will also be produced from lithium, a common element, in the blanket around fusion reactors).

Canada has a National Fusion Program, to coordinate the various activities in this country. We have three major areas of capability, besides our long involvement in nuclear fission:

Extraction and handling of Tritium at AECL Mississauga and U of Toronto

Remote handling (based on the Canadarm)

Tokamak de Varennes for developing materials and techniques.

Funding comes from the Federal and Provincial governments, electrical utilities, industry and universities, totalling about $25M in 1990.

Canada chose to support the Tokamak approach rather than Inertial, and is a member of the European team in ITER.

Safety

The reaction will be difficult to maintain: it will shut down if anything serious goes wrong. There will only be a few grams of fuel in the reactor at any one time, instead of tonnes as in a fission reactor. The exhaust gas is helium, which is not a greenhouse gas. There is no spent fuel to store.

What's in it for us

As members of the IEEE, we have three reasons to be very interested in these developments. Firstly, ours is an Electrical body, and nuclear fusion will be a major new source of power. Secondly, ours is an Electronics body, and the reactors are loaded with electronics - microwave heaters, instrumentation, and computers for control and data processing. Thirdly, as humans we should welcome an energy source relatively free from radioactive pollution which does not contribute to global warming.

Michael Faraday

In commemoration of the 200th anniversary of Michael Faraday's birth (1791-09-022), electric locomotive no. 91013 was named "Michael Faraday" at a ceremony at King's Cross Station in London, UK. After the ceremony the train left on its journey north to Edinburgh as part of the 225 Intercity Service on the newly electrified East Coast route (from IEE News).

Faraday was apprenticed to a bookbinder, then became a laboratory assistant in the Royal Institution where he made discoveries in chemistry. He then turned to electricity and sorted out the relationships between currents and magnets.; He discovered that the plane of polarization of light is rotated in glass in a magnetic field: this was named the Faraday effect. Rotation of EM waves in the ionosphere is another example of the Faraday effect.

Faraday gave his name to the unit of capacitance, the farad (and the microfarad and picofarad). But did you know there is another unit called the faraday? It is 96485 coulombs, the charge required for an electrochemical reaction involving one chemical equivalent (example, to release 1 gram of hydrogen and 8 grams of oxygen from water). It has been said that the highest honour that can be bestowed on a scientist is to have his name commonly spelled without a capital letter.

Total Quality Management - Key to Competitiveness

In today's global market, we are told that we have to be competitive to survive as a country. One of the key factors is Total Quality Management, the subject of a recent IEEE Videoconference (see this newsletter April 1991).

G. Pouskouleli describes in the December issue of Engineering Digest the Japanese system of "continuous improvement" of the product and all operations fo the company, compared with practices on this continent.

In 1982 (Pouskouleli says) IBM decided to have some parts manufactured in Japan as a trial project. According to the specifications IBM would accept 300ppm of the product to be defective... The Japanese commented "We have a hard time understanding North American business practices. But the 3 defective parts per 10,000 have been included and are wrapped separately. Hope this pleases."

Note that Motorola won the Malcolm Baldridge Award by achieving 3.4 ppm (not 300!).