Powering the future

Armando Tura

IESVic researcher investigates gas-dispersion patterns to improve the safety of hydrogen fuel cells.

Energy is a crucial element of society—it is essential for communities to work, play and grow. But our reliance on fossil fuels has a limited future. With climate change, sustainability issues and unstable supplies of energy, Canada and the world need a road map to a different energy future.

Back in 1989—well before energy industry executives, governments and the public understood the severity of the climate change challenge—UVic founded the Institute for Integrated Energy Systems (IESVic) to develop and promote feasible energy solutions.

Since then, IESVic has become an internationally recognized leader in the development of sustainable energy technologies with real-world, practical applications. Working closely with private and public sector partners in Canada and around the world, IESVic researchers investigate entire sustainable energy systems—from the harnessing, storage, transmission and conversion of new energy sources to the delivery of services to communities and industries.

IESVic pioneered Canada's first major university-industry research partnership to study fuel cells and hydrogen systems. Engineers at IESVic used computer models to explore what a large-scale hydrogen economy would look like. And they redesigned fuel cells to be smaller and more efficient. The work resulted in the transfer of 18 patents to industrial partners and spawned a host of new business ventures. It also solidified IESVic's place at the forefront of energy systems research.

In May 2011, IESVic hosted the second annual Canada-China Clean Energy Workshop, where 55 leading energy system researchers from across Canada and China got to know each other and explore collaborative research opportunities.

The workshop included discussions about climate change and the need for science-based solutions, but also focused on new horizons in renewable energy, including fuel cells, smart grid technology and green vehicles.

While plans are already under way for next year's workshop—to be held in Beijing—this year's event is definitely being seen as a success. "Many new relationships were formed between Chinese and Canadian researchers, and plans for a number of exciting collaborative projects were generated," explains IESVic Director Peter Wild.

Many of the projects that will shape our energy future are already underway. Today, IESVic investigates areas as diverse as fuel cell science, cryofuels, hydrogen technology, energy systems analysis and energy policy development, as well as alternative energy sources such as wind, solar, run-of-river hydro, tidal and wave power.

In December 2008 *Science Watch* ranked UVic fifth for citation impact in energy and fuels, largely due to IESVic's research success. *Science Watch* calculated the highest-cited energy research across 94 journals which produced roughly 100,000 papers between 1998-2008. Of the 25 institutions ranked, UVic was in the top five with Princeton, Cornell and the US National Renewable Energy Lab.

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As part of the welcoming events for first-year students in September, the Faculty of Engineering hosted a lively and thought provoking event on diversity and what it means to be a professional, featuring presenters from APEG BC, the Canadian Information Processing Society and the university's equity and human rights office. One of the presenters told the new students that "to discover new shores you have to be willing to sail out of sight of land."

On November 10th at the engineering fall convocation ceremonies, it will be our faculty's privilege to bestow an Honorary Degree on Dr. Calvin Gotlieb, the "Father of Computer Sciences in Canada." Computers are so pervasive today that it's hard to imagine that they were not always around, but there was a beginning and someone "who started it all."

Gotlieb's service to the computing community and his tireless work for the cause of computing is legendary. In 1945 he took up a faculty position with the University of Toronto to develop what is now known as the field of computer science. While his record of "firsts" in computer science are too numerous to list, I will note that he taught the first credit graduate computer science course in Canada in 1950, he co-founded the first computer centre in Canada in 1952, and designed some of the first applications of computers for business and industry. In 1997 he was inducted into the Canadian Information Productivity Awards Hall of Fame for his lasting contributions to technology innovation through the development, management and championing of information technology. Here he joined the ranks of such luminaries as Alexander Graham Bell. It will be our honour to call him an alumnus of UVic.

This fall our faculty has launched two new graduate degrees in conjunction with the Gustavson School of Business: a MBA/MSc Computer Science and a MBA/MEng. These degrees build on the success of the Engineering Entrepreneurship program launched in 2009, another joint venture with UVic Business. You can read about the first graduates of this program on page 3.

Tom Tiedje
Ph.D., FRSC, P.Eng.

Teaching emerging technology

UVic first Canadian engineering faculty to introduce software-defined radio instruction

Electrical and computer engineering students are now learning about a technology of the future in undergraduate and graduate-level telecommunications courses and labs. Designed and introduced this fall by professor Peter Driessen, the new software-defined radio (SDR) curriculum will equip students with knowledge about an emerging technology, giving them a competitive advantage.

"We are pioneering somewhat," says Driessen. "A few schools in the US have already introduced this into their curriculums, but we're the first in Canada that I know of. Some of my UVic colleagues and grad students use SDR in their research."

SDR technology replaces most of the complex signal-handling hardware involved in communications receivers and transmitters with software and wireless technology. Driessen explains that, in its purest form, an SDR receiver might consist simply of an analog-to-digital converter chip connected to an antenna. "The only hardware you're not eliminating is that very first stage where the signal is converted—and the antenna," says Driessen.

"I think it's important for students to learn about software radios because that's what they'll encounter in their careers," says Driessen. "It's just the new way radios are being built." Although not yet common in the marketplace, with the US military being the early adapters of this technology to reduce their hardware costs, Driessen predicts that it will become common in consumer items—such as AM/FM radios, TVs, GPS units, and cell phones—within five years.

Telecommunications instruction to date has focused on understanding and designing the hardware infrastructure of radio systems. In the last few years, the availability of new processors with high computational power has enabled the development of software receivers whose performance is comparable to, or better than, that of conventional hardware devices, while providing all the advantages of a flexible and fully configurable architecture. This means that a single processing unit can be designed to receive and transmit any type of signal by running specific software, enabling that unit to be engineered into any type of radio. With the processing unit being the core of the system, the curriculum focus will now be on programming.

Sweet sounds of a research chair

Tzanatakis

Computers can store thousands of tunes but can they sense when you want to shuffle from hip-hop to experimental jazz? Bringing computers to this next level is part of the research of computer scientist and Canada Research Chair Dr. George Tzanetakis.

"We have access to all this multi-media data and, while computers can store it, they don't really understand it," says Tzanetakis. "In my research I will be designing algorithms—the means to solve a particular problem in a computer program— to extract information from audio signals, especially music, and build tools to create more effective interactions between computers, listeners and musicians."

Audio retrieval technology is already being used in commercial applications such as internet radio sites which "broadcast" only music pre-selected by subscribers. But Tzanetakis, a musician himself, wants to improve and expand on the technology's capability.

"Smart phones already have the ability to determine location and time. By tracking an individual's patterns of activity, a phone could also determine when you've left the gym, are studying on the bus and want to listen to a different kind of music," says Tzanetakis.

Short a drummer for your combo? Tzanetakis is also developing a robotic percussionist that can improvise with human performers.

"Improved technology has the potential to completely transform the way we find and create music as well as improve the ability of computers to understand complex mixtures of sounds," he explains.

Tzanetakis recently returned from a six-month sabbatical as a visiting scientist with Google Research where he worked on analyzing audio and music signals in millions of You Tube videos.

Deddeda Stelmer

Students working in the green garage.

UVic clinches spot in EcoCAR2

This fall, a new team of engineering students is participating in the next round of North America's elite "green" car competition, EcoCAR 2–Plugging into the Future. Over the last three years UVic's first team competed in the EcoCAR–Next Challenge competition, winning 22 awards. It built a fuel-efficient, low-emission car of the future as part of an international contest that challenges 16 universities to create a next-generation green vehicle that minimizes fuel consumption and emissions and encourages energy diversity.

The EcoCAR2 team will be working on a car with the latest drivetrain architectures and control methods, striving to achieve significantly improved fuel-economy ratings over existing vehicles. The students educated through the team's activities will start their careers with the knowledge needed to drive the innovations that will be required over the next 10-20 years to meet increasingly stringent environmental performance targets being mandated by governments around the world, such as the 2025 fuel economy standards announced by the US government in July.

This team will have the advantage of working from UVic's new "green garage" —a state-of-the-art workshop and vehicle-testing facility. The workshop includes vehicle lifts and specialty tools, as well as clean facilities for high-voltage assembly and specialized controller-testing hardware. The vehicle-testing facility includes a four-wheel chassis dynamometer that allows vehicle testing in controlled conditions up to highway speeds. An additional component allows testing of engine/transmission elements when removed from the vehicle.

Four previous EcoCAR team members are now working at General Motors: Jeremy Wise (MASc 2011) and Shaun Bowman (MASc 2010,) both with GM Hybrid Powertrain, Michigan; Joon Hwang (BEng 2010) with GM Electric and Power Systems, Michigan; and Tom Grime (BEng 2011) with GM Canada, Oshawa. Another four EcoCAR members, working as research assistants now at UVic, will soon join GM Hybrid Powertrain in Michigen as well: Jeff Waldner (MASc 2011, projected), Joshua F. Pacheco (BEng 2011), Trevor Davis (BEng 2011), and Yuliang Leon Zhou (PhD 2011, projected).

Innovative graduate program

The Engineering Entrepreneurship master's program is one of the "20 Most Innovative Companies" in BC. That's according to *BC Business Magazine*, which describes the program as "impressively inventive" and growing "ideas that have a business plan encoded in their DNA."

Through a unique partnership with Wesley Clover International, an Ottawa-based investment company, engineering students are being given the opportunity to graduate with a master's degree, a diploma in entrepreneurship delivered by the Gustavson School of Business, and equity in a business they helped form.

Now in its third year, Engineering Entrepreneurship@UVic has successfully launched one student company, a second team of students has completed their initial eight months of coursework, and a third began their 20-month journey this September.

The first student team of Jeff Crowe (BSEng 2009), Torben Werner (BSEng 2009), Logan Volkers (BEng Electrical 2009), and Will Fraser (BEng Electrical 2009) graduated with their MASc/ Diploma Entrepreneurship this summer. Their company, YUPIQ Solutions Ltd., is launching customer sites in North America and the UK this fall. YUPIQ provides a suite of tools to help companies empower their fans and increase their sales through social media. For more info, go to www.ece.uvic.ca/~eemp or YUPIQ.com

Alumna gives back

By Mira Davidson

Panda Isarasakdi (BSc Computer Science 2000) is making sure her restaurant lives up to its slogan of being "Big Beyond Taste®" through a unique partnership that benefits CanAssist and current engineering students.

Isarasakdi, who was an international student from Thailand, fondly recalls the long nights she spent studying in the old engineering building with a diet of mostly vending machine food. "My UVic years helped form my skills, discipline and values that have contributed to my success in life." While her classmates have now scattered around the world, Isarasakdi keeps in touch. "There were very few women in computer science back then and we forged some great friendships."

While studying at UVic, she met her future husband, Rod Jiang. In 2003, they opened the Victoria restaurant, Little Thai Place. Today, they have four locations locally and have expanded into pre-packaged foods that will soon be in grocery stores nationally. Ironically, these ready-to-eat Thai curries would have made the perfect dorm food during Isarasakdi's vending machine days.

Isarasakdi and Jiang are giving back by donating half the proceeds of the pre-packaged meals purchased at their restaurants to CanAssist, a unique UVic organization dedicated to improving the quality of life for those with special needs. "A significant portion of our customer base is UVic students. We wanted to give back to the university to show our appreciation," says Isarasakdi.

Funds raised during the year-long initiative will help CanAssist develop new technologies, hire engineering co-op and graduate students to develop these technologies, and much more. "We're so grateful to Little Thai Place and are truly touched by their generosity," says Nigel Livingston, CanAssist director.

In addition to the CanAssist initiative, this fall Isarasakdi and Jiang are offering engineering students in a first-year design class the opportunity to experience what it's like to work with an entrepreneurial client on an industry-based design project. "This kind of opportunity for our students in their first year is rare and the Little Thai project poses just the right level of challenge," says professor Peter Wild. UVic design engineer Sean McConkey adds, "It's amazing to see alumni businesses interacting with the students in this way."

Rod Jiang and Panda Isarasakdi (BSc 2000)

Meet the people
New adjunct professors

Kris Caputa holds a PhD (Electrical and Computer Engineering) from UVic. After post-doctoral work here, in 2004 he joined the NRC Herzberg Institute of Astrophysics in Victoria, where he currently works on the development of electronics for unique astronomical instruments, such as the Gemini Planet Imager to be delivered in 2012 to the Gemini Observatory in Chile, and the NFIRAOS, the adaptive optics system for the Thirty Meter Telescope to be operational in 2018. He was appointed as an adjunct professor in the electrical and computer engineering (ECE) department in September.

Atef Ibrahim is currently a researcher at the Electronics Research Institute, Cairo, Egypt. His research interests include computer arithmetic, cryptography, and VLSI design. He holds a PhD (Electronics and Electrical Communications) from Cairo University. From 2008-2010, he was a visiting PhD student in UVic's ECE department and now has accepted an adjunct appointment with that department.

Peter Fox is a specialist in active remote sensing systems, transducers and algorithms. He is currently Principal System Engineer at Kongberg Mesotech Systems, responsible for new multibeam imaging sonar systems. Prior to this he worked on the Radarsat-2 Program, working on the world's most sophisticated space-based synthetic aperture radar, which has been successfully operating since December 2008. Fox holds a PhD (Electronic Engineering) from the University of Cape Town and began an adjunct appointment this fall with the ECE department.

Colin Swindells is a human-computer interaction researcher. His research typically involves user studies to empirically define mathematical models that inform better user interactions between computing systems and people. Colin is currently Lead Pricing Scientist at Advanced E-Commerce Research Systems Inc. where he helps eBay, Yahoo! Japan, and other merchants make more profitable decisions. Colin holds a PhD (Computer Science) from UBC and began an adjunct appointment in September with the computer science department.

Digital Pioneer

Every time we pick up our cell phones or watch a movie on our high-definition TVs, we can thank electrical engineering professor emeritus Andreas Antoniou, winner of the 2011 Craigdarroch Gold Medal for Career Achievement in Research. In the early 1970s, Dr. Antoniou recognized the enormous potential of digital technology and dedicated his research career to digital signal processing. His invention of an electrical circuit known as the "Antoniou gyrator" paved the way for the miniaturization of circuits for everyday devices such as cell phones and HDTVs. On Nov. 22, Dr. Antoniou will also be awarded the 2011 UVic Legacy Research Award for his pioneering work.
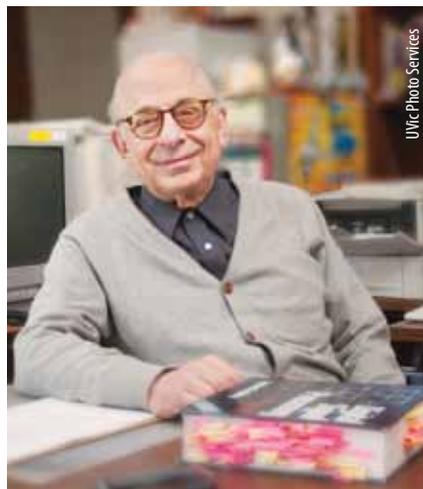
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Making a Mark
Faculty milestones and achievements

Society of Manufacturing Engineers

Mechanical engineering professor Martin Jun is one of 12 winners of the Society of Manufacturing Engineers' Outstanding Young Manufacturing Engineer Award, which recognizes young manufacturing practitioners who have made exemplary contributions and achievements in the manufacturing industry. Jun is the only Canadian among the winners.

Jun's current research interests include nanoparticle deposition, development of sustainable cutting fluid and application system, development of micro/nanometrology systems, and understanding micromachining mechanics and dynamics. His various research projects have attracted significant funding from the Natural Science and Engineering Research Council and interest from the industry. Jun has written more than 35 publications, which have appeared in several leading journals in manufacturing and refereed conference proceedings.

IEEE Wireless Communications

Electrical and Computer Engineering professor Lin Cai, and her PhD student, Yuanqian Luo, received the Best Academic Paper Award in IEEE Wireless Communications and Networking Conference (WCNC) in March 2011. IEEE WCNC is the world premier wireless event that brings together industry professionals, academics, and individuals from government agencies and other institutions to exchange information and ideas on the advancement of wireless communications and networking technology.

Canadian Academy of Engineering

Faculty Dean Tom Tiedje was inducted into the Canadian Academy of Engineering in June. Fellows are elected by their peers in recognition of their distinguished achievements and career-long service to the engineering profession.

Power breakfasts

The UVic Engineering Alumni Chapter has relaunched itself under the initiative of BC alumni Doug Ransom and Catherine Roome, both BEng Electrical 1990. They've launched a web site and initiated monthly breakfast meetings to network, with the inaugural ones taking place in Vancouver and Victoria in August. Alumni worldwide are invited to get involved, either by hosting a breakfast in your city or getting connected through the chapter's LinkedIn group—UVic Engineering Alumni. For more info, go to https://sites.google.com/site/uvicengineeringalumni