INSTITUTE FOR COMPUTING, INFORMATION AND COGNITIVE SYSTEMS •I•C•I•C•S•

ICICS FOCUS

THE UNIVERSITY OF BRITISH COLUMBIA

Sending the Right Signals

Matt Yedlin's ultra-wide band antenna has a wide range of applications, from wireless data transmission to landmine detection.

ICICS member Matt Yedlin, "Cellist on the Roof."

If you hear the strains of a cello drifting down from the rooftops of Matt Yedlin's antenna lab, don't be surprised. His new ultra-wide band antenna (UWBA) isn't the only thing sending signals from up there. The new UWBA can emit pulses down to one billionth of a second over huge bandwidths (up to 10 GHz), instead of the narrow-bandwidth tones of conventional antennas. Operable from 100 MHz to 100 GHz, the UWBA has a range of over three orders of magnitude. Previously, it took many antennas working together to emit such pulses.

UBC has filed a patent application for the UWBA, developed by Ph.D. student Kim Dotto, supervised by Yedlin.

Inside the newly constituted antenna range, which is one of the few in Canada, Yedlin and Dotto are interpreting new data with a fully functioning tomography apparatus used to image the interior of solid objects. They have truly been resourceful, developing their state-of-the-art antenna on a shoestring budget. To date, they have spent less than three thousand dollars, a third of which went into a computer data-acquisition card. To realize the potential of the UWBA's rich application possibilities, Yedlin is seeking governmental and commercial funding partners.

A diversity of applications

The UWBA has several powerful applications, including wireless data transmission, non-destructive testing (sending energy in and back through a structure to see what is inside, without affecting its integrity), and ground-penetrating radar, including landmine detection.

In the blossoming field of wireless telecommunications, the UWBA enables interception and jamming-resistant transmission of confidential data. The US Federal Communications Commission has just approved the unlicensed low-power use of the spectrum above 2.1 GHz, and while there is a project in Alabama also focused on this application, Yedlin and Dotto's antenna provides a wider bandwidth.

An interdisciplinary researcher

The number of possible applications of the UWBA is a reflection of Yedlin's diversity of interests. He holds an Honours B.Sc. in Physics (he was the Lieutenant-Governor's gold medal winner in his graduating year), an M.Sc. in Neurophysiology and a Ph.D. in Theoretical

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ICICS
Director's Corner

In today's economic climate it is more important than ever to acknowlede the accomplishments and achievements of our ICICS members. It is through their research developments, collaborations and industry partnerships that BC will grow and thrive.

The spring issue of FOCUS features the work of Jeffrey Joyce, who recently returned to ECE from Raytheon, where he led the safety analysis of the Canadian Automated Air Traffic System (CAATS). Prior to Raytheon, Jeffrey was an assistant professor in Computer Science. We are happy to welcome him back, as his work will have important applications in the safety of all high-integrity systems.

How we perceive and how we reason form the basis of the work of Computer Science faculty members Alan Mackworth and Ron Rensink (joint with Psychology). Alan and the research group in the Laboratory for Computational Intelligence are world-leaders in this exciting field. Ron has recently secured $1.4 million from Nissan to study human perception and attention.

We will also look at the work and passions of Gary Schajer (ME) and Matt Yedlin (ECE). Gary is an associate member of the Centre for Advanced Wood Processing Control in the Faculty of Forestry. Matt has developed an ultra-wide band antenna with applications in radar, telecommunications, and tracking.

Michael Davies' term as head of ECE will be profiled and we also have an update on the opening of the new System-on-a-Chip Laboratory headed by Resve Saleh.

Rabab Ward, ICICS Director

Pro-Active–Michael Davies' Term as ECE Head

A new building, thriving research, and a commitment to teaching and learning

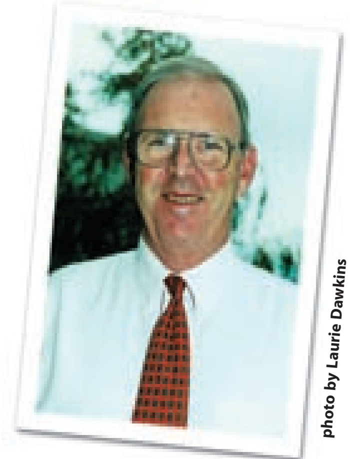


photo by Laurie Dawkins

"Our biggest responsibility as educators is to meet the aspirations of the young people of BC and Canada. We turn too many away each year, not because they aren't qualified, but because we don't have enough places."

Soon to complete a five-year term as head of Electrical and Computer Engineering (ECE), Michael Davies is ready for a long-overdue leave. Prior to being appointed department head, he was associate dean of the Faculty of Applied Sciences for ten years.

"It has been a stressful but very exciting period," says Davies, "We have accomplished a lot, thanks to a great group of faculty, administrative and technical staff." He cites two critical and parallel issues the department has had to contend with. The first is the burgeoning number of students pursuing careers in electrical and computer engineering as the field becomes increasingly pertinent to all aspects of life. Second, the demand for experts in the private sector has made it more difficult to hire and retain good staff.

Faculty excellence

Davies says that since the economy has slowed down, and the university has recognized that salaries in ECE and Computer Science must be competitive, the department has been able to fill vacancies with excellent applicants. He also acknowledges the strong support ECE has received from alumni, the Faculty of Applied Science, the President's Office, as well as the provincial government in its plan to increase the number of places available in CS and ECE. "With the Dean's leadership we have raised major development funds toward a new building, which will extend from the north end of the existing MacLeod building."

Under Davies' term as head, research has been thriving. ECE members made a major contribution to the ICICS proposal and its subsequent funding. The department is now involved in six of the seven clusters. ECE has received five major CFI awards in addition to its involvement with ICICS, and two Canada Research Chairs—with two more anticipated soon. Michael Jackson received CFI funding for his work in advanced, high-speed microelectronics, Tim Salcudean for multi-modal simulators and user interfaces, and Resve Saleh for his work in System-on-a-Chip (see page 8). Robert Rohling and Babak Hamidzadeh have also received CFI funding. Saleh was named NSERC-PMC-Sierra Industrial Research Chair and Peter Lawrence has been awarded an NSERC-Design Chair.

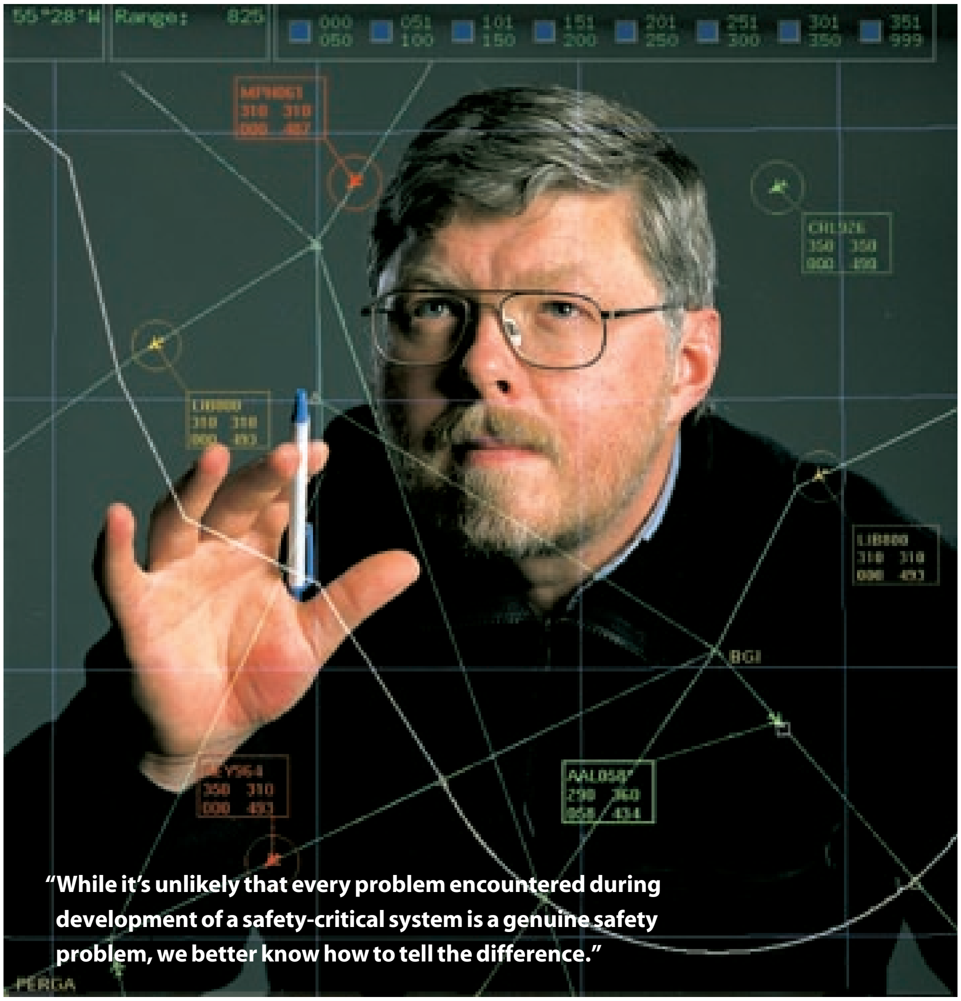
Creative tinkering

In order to maintain the legacy of educational excellence, another challenge is to encourage the passion for creative "tinkering" in undergraduates, says Davies. Students who entered engineering in the past were hobbyists; they fixed their own cars, built their own stereos and computers, and generally were much more practice-oriented. With the emphasis on grades and competitive entry, engineering students today become very good in math and physics, but sometimes at the expense of acquiring hands-on understanding.

"We have to inject a bit of curiosity back into the learning process," he says, noting that the second-year Project Integration Program was designed to help students relate what they learn academically to tangible engineering problems. "We also need to make sure that we are educating people in things that are appropriate for the coming decades and for the industries that will give us prosperity in the future."

Safety in Complex Software Systems

Jeffrey Joyce is redefining safety in high-integrity software systems and establishing techniques to reduce risk.



"While it's unlikely that every problem encountered during development of a safety-critical system is a genuine safety problem, we better know how to tell the difference."

Software systems perform an increasing number of critical functions in our lives—many we are not even aware of. We trust the software in our cars to regulate the braking system, just as we trust software to provide air traffic controllers with critical radar and flight data needed to orchestrate the complex, three-dimensional web of flight trajectories in the sky. "We depend on computers to perform critical functions, yet take it as a matter of course when our desktop computer crashes," says Jeffrey Joyce, ICICS member and professor of Electrical and Computer Engineering.

Making dependable software

Joyce recently returned to UBC from seven years with Raytheon, where he led the safety analysis of the Canadian Automated Air Traffic System (CAATS) and a related military system. Before joining Raytheon, he was an Assistant Professor in Computer Science at UBC. He notes that most of the safety-related software produced by the aerospace industry is developed using a more rigorous, formal and expensive process than those used to develop most other kinds of software.

Joyce would like to see what he has learned from the aerospace industry incorporated into the curriculum of the new Software Engineering Option offered in the Department of Electrical and Computer Engineering. "Not every student is going to end up developing safety-critical software," he says. "However, many of the basic principles could be scaled down and adapted to benefit almost any kind of software development."

A key step in the development of a safety-related software system is the written specifications of its requirements. For a complex system such as CAATS, this could easily involve tens of thousands of sentences. A significant challenge in the development of such systems is minimizing ambiguity and inconsistencies in the requirements, especially when specifications are expressed in everyday, or "natural," language. Part of Joyce's research program at UBC is concerned with developing practical techniques and tools to address this challenge. These include the use of "lightweight" formal description techniques that strike a balance between mathematical rigour and readability for non-mathematicians.

The other main focus of his research is the safety analysis of software-intensive systems. In mechanical, chemical, nuclear, and other non-software systems, safety analysis typically emphasizes component failure. Unlike the physical components of these systems, software components do not crack, rust or wear out. Instead, hazards in software systems can usually be traced back to its requirements. With many thousands of requirements in a system, pinpointing safety-critical ones poses a considerable challenge.

Industry-University collaboration

While at Raytheon, Joyce was also an adjunct professor at UBC, supervising three PhD students and one MSc student. Three of his PhD students, Nancy Day, Michael Donat and Ken Wong, were involved in an industry-university collaboration funded by the Advanced Systems Institute, Raytheon, and MacDonald Dettwiler. The project, called FormalWARE, investigated the industrial application of formal description, tool-based analysis and other techniques in the development of safety-critical systems.

"The Raytheon experience was fantastic and generated a program of research that will probably keep me busy for a good part of the rest of my career," says Joyce. "Now I can take what I have learned in industry and turn it into knowledge that can be used more widely."

E-mail Jeff Joyce at jeffj@ece.ubc.ca or call him at 604-822-7281.

Out of Mind–Out of Sight

Ron Rensink recently secured $1.4 million from Nissan to study human perception and attention.

"The car is a good test case for future technology, such as wearable computers and smart homes, because it involves many of the same issues of how humans and machines can best interact."

The automobile has come a long way since the Model T. Automatic transmission, cruise control, air conditioning, and CD players have added pleasure and convenience to driving. But with more traffic, increased speed, and cockpit-like dashboards loaded with monitors and controls for everything from RPMs to music volume—driving has become increasingly complex. Not to mention the distraction of cell phones, busy intersections, flashing lights, and ubiquitous advertising billboards. We have a lot to pay attention to.

Too much in fact, says Ron Rensink, ICICS member and assistant professor in Computer Science and Psychology. And with the addition of intelligent systems (like the ones the Laboratory of Computational Intelligence is helping to develop) cars will soon be able to give more information to the driver, such as the condition of the road ahead, or the presence of a vehicle in a driver's blind spot. One of the questions Rensink is trying to answer is how much information is too much?

Nissan partnership

Rensink's groundbreaking work on change-blindness, undertaken at Cambridge Basic Research (CBR) in collaboration with MIT and Nissan, showed that if our attention is focused elsewhere, we simply don't see that the car ahead has braked, or that a pedestrian has stepped off the curb. When he heard that Nissan wanted to fund a new lab after the closure of CBR, he invited his former colleagues to visit UBC in the hope of securing some of the funding. Instead, he got all of it. "Not only do we have some of the best people in the world here, we work well together and collaborate on projects," he says. "In the US, the research environment is more competitive, which makes effective multidisciplinary collaboration more difficult."

Nissan has committed $1.4 million to research at UBC over the next 18 months. The partnership currently involves engineers at Nissan's Vehicle and Transportation Research Laboratory in Yokohama and five UBC researchers: Rensink, Karon MacLean from Computer Science, and Alan Kingstone, Jim Enns, and Vince DiLollo from Psychology. In March 2002, the group will expand to include researchers from Human Kinetics, Linguistics and Philosophy. Much of the funding will support graduate and post-doctoral researchers.

This type of industry-university collaboration—partnering very basic and very applied research—is exactly what ICICS fosters. These researchers will be investigating the scientific basis of intelligent automobile interfaces. One aspect of their work will be to determine the limits of human perception and cognition in order to establish the effectiveness of an interface. They also want to determine the extent to which new kinds of sensory input, such as sound or touch, can be used to convey information.

Mindsight

Rensink's work in visual attention has led to other unexpected discoveries. Some people can actually sense or "feel" change without seeing it. The phenomenon, which Rensink calls mindsight, is a conscious, non-sensory experience: the "gut feeling" that something is happening. In trials of flickering images, subjects were asked to indicate when the image changed. Such a large number of participants asked if they should hit the space bar when they felt something change as well as saw it, that Rensink became intrigued. The people who felt change were also able to identify control trials, where images flicker but don't change.

Too much information

Another effect he discovered was that we can only attend to one thing at a time. Even though we can keep track of four or five things at once, we simply can't see two changes occur simultaneously. So how do we define units of attention? "These are all abilities and limitations that we have to consider when we are designing technology," says Rensink. He acknowledges that his work is a bit metaphysical for some colleagues. "When you present an idea that upsets journal reviewers, it's a good sign that you are on to something big."

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It Shoots–It Scores!

The Dynamics of Computational Intelligence

Soccer-playing robots developed by Alan Mackworth's group can perceive, strategize, co-operate—and score goals.

"The essence of control theory is that you get feedback from the world and integrate that into the reasoning process," says Mackworth.

What defines intelligence? Linguists would say language. Anthropologists would argue the ability to use tools. Computer Science Professor and ICICS member Alan Mackworth believes that computation is the essence of intelligence. As Canada Research Chair in Artificial Intelligence and founding director of UBC's Laboratory for Computational Intelligence (LCI), his opinion carries the weight of considerable expertise.

For Mackworth and his LCI colleagues, the primary characteristic of an intelligent agent—whether human, animal, or robot—is that it has purposes or goals and acts appropriately to achieve them. In other words, it is proactive. It must also be reactive, by responding appropriately to changes in its environment. "If an agent exhibits both proactive and reactive behaviour, then we believe it meets the necessary and sufficient conditions for intelligence," says Mackworth. "The ability to use tools and language comes about as a result of being proactive and reactive."

Laboratory for Computational Intelligence

Although Mackworth admits that everyone might not agree with this paradigm, it is essential in designing computer systems and robots that can perceive, reason, and interact in dynamic environments in real time. This is a far cry from earlier GOFAIR robots developed as single agents in a static, controlled environment. Traditional AI concentrated on the proactive process, notes Mackworth, whereas a reactive process, such as cruise control, involves a control system.

The challenge is integrating AI and control theory in a scientifically rigorous way. Mackworth and colleagues started UBC's program in AI and robotics in 1984 and it was the first to be funded by the Canadian Institute for Advanced Research (CIAR). It evolved into the Institute for Robotics and Intelligent Systems (IRIS), a national Networks of Centres of Excellence under the umbrella of Precarn, a not-for-profit, industry-led consortium that helps to bridge the "innovation gap" between basic research and commercial applications.

Soccer-playing robots

The real test of computational intelligence is in multi-agent systems, where the actions of each agent—either human or machine—and input from the environment affect reasoning and decision-making. Take soccer for example. With funding from IRIS, Mackworth and colleagues developed soccer-playing robots. The Dynamo project uses remote-control toy vehicles for the physical agents, an off-board camera and computers for perception, reasoning and control. LCI's robot team "The Dynamites" analyse the play 60 times per second and convey visual information, such as speed, direction, and position, back to the computers' controllers, in effect, planning their strategy as the game progresses. What started as a lab experiment with two robotic trucks has become an annual international event. Robocup, sponsored by Sony, now has several leagues and up to eleven robots per team.

Constraint Nets

All fun aside, these high-tech toys were designed to test constraint-based theories. The Dynamo robots run on Constraint Nets, a software system developed by Mackworth. The idea behind Constraint Nets is to think of both the agent body and the controller as a dynamical system, or a model of computing where the output affects the input in a closed loop. This involves integrating a hierarchy of control systems from the robot-body and

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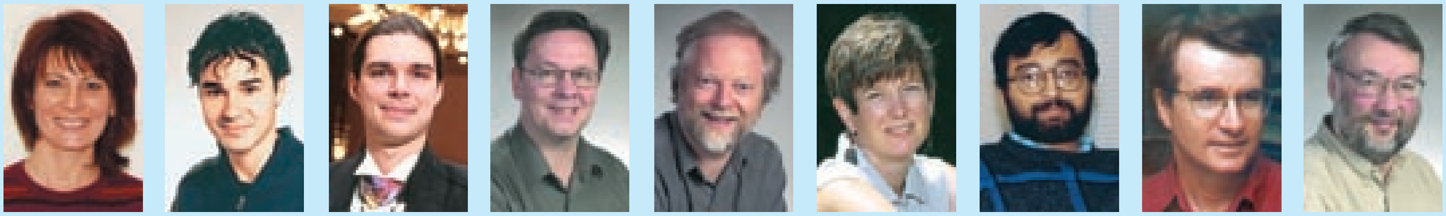
Laboratory of Computational Intelligence (LCI) Researchers



Christina Conati Adaptive interfaces, computer-aided instruction

Nando de Freitas Probabilistic machine learning, computational statistics

Holger Hoos Dynamic constraint optimization, local search algorithms

Jim Little Computational vision, stereo and motion

David Lowe Object recognition, motion tracking

Karon MacLean Haptic interfaces, multisensory interaction

Dinesh Pai Reality-based modelling, multi-modal interfaces

David Poole Preferences, planning and probabilistic systems

Robert Woodham Computer vision, remote sensing

Working in Wood


With the BC lumber industry struggling, Gary Schajer's research in process control is more critical than ever.

Chunks of wood, antique saw blades and a motley collection of frogs adorn Mechanical Engineering Professor Gary Schajer's office. His passion for the lumber industry began over twenty years ago, when he worked with Weyerhaeuser Company in Tacoma after finishing his PhD. His passion for frogs goes back much further. Schajer began his research and teaching career at UBC in 1989, and is now director of the Renewable Resources Lab and an associate member of the Centre for Advanced Wood Processing in the Faculty of Forestry. "Anything we can do to save raw material has a huge payback," says Schajer. Finding ways to reduce waste—and better ways to use it—is the crux of his research.

"The biggest economic issue in the wood industry is that about 75 percent of the cost is in raw material."

Enhancing woodcutting processes

To keep sawdust and waste to a minimum, industrial saw blades are made as thin as possible. However, thin saw blades are flexible and unstable, making straight cutting more difficult. And what is saved in sawdust is often lost in the planing of crooked boards. Clearly, the business of woodcutting is far from cut and dried. In fact, understanding the details of the woodcutting process is an extremely complex task, says Schajer, because wood is a natural material with very high variability. Differences in grain, density, moisture content, and knots make it difficult to interpret experimental results and determine what aspects are significant.

Recent developments in sawing techniques have improved the amount of lumber produced from raw logs. However, these techniques are still not well understood. Guided saws, in which the blade is secured on either side, involve highly non-linear interactions between the saw body, the saw teeth and the wood, and these are much more difficult to analyse. Schajer is working to discover the real factors that determine the operation of this type of saw blade in order to explain its effectiveness and improve design.

Schajer is also developing laser sensors that separately measure both top and bottom surfaces of sawn lumber to better determine thickness and quality. Information about individual surfaces helps to detect certain types of machine problems, thereby enhancing quality control on both product and machinery. And since more wood is planed off the top of a piece than the bottom, it also determines which side should be "up," again reducing waste. In this project, Schajer is working with Professors Tom Maness and Rob Kozak of the Wood Science Department, MASc student Javier Gazzarri, and industrial partner Hermary Opto Electronics, a BC firm.

Particleboard: value-added waste

"The main feature of particleboard is that it is made from sawmill floor sweepings," says Schajer. Consequently, the material is irregular, and cut surfaces are very rough and prone to chipping—not attractive qualities in a consumer item. The cost of finishing cut surfaces can be greater than all other costs combined. The challenge is to find better ways to cut and process particleboard. This involves determining the right mix of woods, particle size, the best glue, and the optimum temperature and pressure for processing.

Working with Schajer for his PhD studies is Darrell Wong who is also a research engineer with Fornitek Canada Corporation and former assistant director of the Centre for Advanced Wood Processing.

Measuring residual stress

Not all Schajer's work is in wood. He also works on improved methods for measuring residual stresses. These hidden stresses, created during most manufacturing processes, can seriously affect fatigue life and dimensional stability of a material—not something you want to consider when boarding an airplane. Residual stress is measured by removing a small sample of material and measuring the nearby strain changes. Schajer developed a six-element strain gauge that is included in the official ASTM standard test method specification.

Schajer's challenge is finding a balance between simplicity and realism. "I agree with Einstein, who said 'theoretical models should be as simple as possible, and no simpler.'"

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Yedlin, *continued from page one*

Seismology. After a Stanford Geophysics Post Doctorate, Yedlin went to Conoco Inc. as a Research Geophysicist. In 1989, he received a tenure track position at UBC, equally split between ECE and Geophysics.

Yedlin observes that while the value of his interdisciplinary training is clear, administratively the mechanisms have been less than adequate. While many extol the value of interdisciplinary research, they may not realize that the process takes longer and that such researchers are often thought of as "fence sitters." Yedlin asserts that to have true interdisciplinarity, a new paradigm needs to be adopted to reduce the obstacles. Director Rabab Ward expects that within ICICS, "...in the future, researchers like Matt Yedlin will be seen as the movers and shakers behind collaborative research initiatives."

Philosophy

All professors deal with stress, and when asked how he deals with his, Yedlin gives an enigmatic grin. His colleagues know Matt Yedlin as a smiling face. He enjoys teaching, and earned the Killam Teaching Award in 1994. Married for twenty years, he regularly attends ballroom dance classes at UBC with his wife. He has enjoyed playing cello since he was nine, and has a sixteen-year-old son. "Know when to ask for help" is one piece of advice he offers, but for new faculty Yedlin recommends mentoring. He feels it is the key to reaching a successful balance between "being" (coping), "doing" (getting work done) and "having" (achieving start-up funding). Often the "being" is merely assumed in the rush to do and have. Yedlin believes this is the root of stress, and where mentoring plays a vital role in a new professor's success. His advice to new faculty comes in the form of a question: "Where are you going to *be* ten years from now?" Playing cello on the roof of a very progressive antenna lab is not a bad answer.

E-mail Matt Yedlin at matty@ece.ubc.ca or call him at 604-822-8236.

on the roof: Matt Yedlin (c.) with graduate students Kim Lam (l.) and Kim Dotto (r.)

·I·C·I·C·S· Passing Notes

Anne Condon (CS) recently won the University College of Cork distinguished Alumnus Award for 2001—the highest honour that University bestows on an alumnus. Anne is currently co-chair of the Computing Research Association's Committee on the Status of Women in CS and ECE.

Dean of Science, **Maria Klawe** (CS) received the Science and Technology Champion of the Year award from the BC Science Council for her "outstanding contribution in promoting and fostering BC Science and Technology."

Charles Laszlo (ECE) has won the Gold Medal from the Canadian Council of Professional Engineers.

Farrokh Sassani (ME) has been elected a Fellow of the American Society of Mechanical Engineers.

Gary Schajer (ME) has been elected a Fellow of the American Society of Engineers.

Vinod Modi (ME) is the first Canadian to receive an Honorary Membership in the Japanese Rocket Society.

José Marti (ECE) has been elected a Fellow of the IEEE for his work in developing electromagnetic transient programs for transmission line modeling and real-time simulation.

Matthew W. Choptuik (Physics) received the Rutherford Memorial Medal (Physics) from the Royal Society of Canada.

Cristina Conati (CS), **Sidney Fels** (ECE), **Bryan Gick** (Ling.), and **Alan Kingston** (Psych.) received the Early Career Scholar Award of the Peter Wall Institute In Advanced Studies.

Peter Lawrence (ECE) has been awarded an NSERC Chair in Design for his work in sensing and signal processing for telerobotic systems.

Janet Werker (Psych.)has been elected a Fellow of the Royal Society of Canada.

The third annual **PMC-Sierra Science Fair Foundation Fun Run** takes place Sunday, June 2, 2002. For registration and information visit www.ScienceFairs.bc.ca, or email scifair@scienceworld.bc.ca, or call the Fun Run Hotline at 604-443-7552.

Mackworth, *continued from page five*

low-level motor control to high-level controllers. "The trick is that the constraints are changing while you are trying to solve them," he says.

Mackworth believes that a theory of computational intelligence will not only help to build intelligent systems, but to understand human behaviour and apply that knowledge to developing better technology.

"Understanding cognitive systems is extremely important," he says, noting the work of ICICS colleague Ron Rensink. This research involves several ICICS clusters, with collaborators in psychology and philosophy. "Constructing intelligent models of the user is probably the best way to design computers that better support human activity."

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System-on-a-Chip Lab makes media waves

UBC a world-leader in microchip design

The SoC faculty members include (from left) Alan Hu of Computer Science, and David Pulfrey, Andre Ivanov and Resve Saleh (all of Electrical and Computer Engineering). Members not present: Hussein Alnuweiri, Mark Greenstreet and visiting researchers Dr. Yong Cho and Dr. Yong Lee.

The high-profile launch of UBC's new $3.2-million System-on-a-Chip (SoC) Research Laboratory last November has put ICICS researchers and Vancouver on the map as world leaders in the evolution of microchip design. Spearheaded by ECE Professor Resve Saleh, it is currently home to seven faculty members, two visiting professors, and twenty-five students. As major players in Canada's System-on-a-Chip Research Network, lab members are working to streamline silicon chip design to keep pace with the demands of technology.

One billion transistors

Currently, a microchip houses 20 to 30 million transistors. By the end of the decade, designers want to be able to put over a billion transistors on one chip. This technology is essential for developing new generation products such as mobile phones and computers that use Bluetooth™ wireless technology for personal area and internet connectivity.

Funding partners for the lab include the Canadian Microelectronics Corporation (CMC), PMC-Sierra, the Canadian Foundation for Innovation (CFI), the BC Advanced Systems Institute (ASI), the BC government's Knowledge Development Fund, NSERC, Micronet, and Prince Rupert's City Tel.

The idea behind SoC is to build upon previous designs so that each chip doesn't have to be built from scratch—an expensive and time-consuming process. The focus of the lab's work is mixed-signal design, verification and testing. SoC researchers have recently embarked on a Bluetooth™ wireless chip design in partnership with CMC and Tality Corporation. "By analogy, in order to build a new car engine you need a car to put it into," says Saleh. "We are essentially using this chip as a design platform for our research."

A leading expert on SoC, Saleh is chair of the technical advisory committee for CMC, conference chair for the 2002 International Symposium on Quality in Electronic Design, and associate editor of IEEE. He has fielded many interviews lately. At the time of this one he was heading to Ottawa, to be interviewed for an upcoming PBS documentary on SoC, narrated by Morley Safer. Stay tuned for more news!

Res Saleh can be reached at res@ece.ubc.ca or 604-822-3702.

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UBC's Institute for Computing, Information and Cognitive Systems (ICICS) is an umbrella organization that promotes collaboration between researchers from the faculties of Applied Science, Arts, Commerce, Dentistry, Education, Forestry, Medicine, Pharmacy, and Science. ICICS supports the collaborative computer-oriented research of more than 120 faculty members and over 500 graduate students in these faculties. ICICS researchers attract approximately $15 million in annual grants and contracts. Their work will have a positive impact on us all in the future.

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