Optimizing Pulping Processes

Chemical and Biological Engineering professor Chad Bennington uses chemical reaction engineering to improve pulping processes, with a focus on mixing operations.

"There's an opportunity here to make things a lot better, to save resources and make better pulp."

▸ **Chemical Reaction Engineering**
▸ **Mixing Fibre Suspensions**
▸ **SmartChip**

Papermaking was invented by a Chinese court official in 105 AD. The technology spread rapidly through trade routes, and has been integral to the dissemination of knowledge ever since. Papermaking is also integral to the Canadian economy—despite recent slowdowns, annual exports from the pulp and paper sector total roughly US $14B. Chad Bennington, NSERC/Paprican Industrial Research Chair in Chemical Pulping Technology, helps the Canadian industry retain its competitive edge by applying his expertise in chemical reaction engineering to a wide range of problems in pulping unit operations.

Getting the Mix Right

Pulping involves liberating the cellulose fibres that form the basis of paper from the wood matrix. In mechanical pulping, logs or wood chips are broken down into fibres by mechanical means. In chemical pulping, lignin, the "glue" that holds the fibres together, is dissolved through a series of chemical reactions. In the kraft process, the most common chemical pulping

The Strategic Plan that will chart ICICS' course over the next five years has been finalized by our Planning Committee and membership, and is now being implemented. As part of this process, we are exploring possible new partnerships with similar organizations, as well as opportunities to enhance the learning experience and skill set of ICICS graduate students. We continue to welcome member input, and will keep you apprised of further developments.

This year's Distinguished Lecture Series features five well-known researchers whose work ranges from using nerve cells for computation, to realizing aspects of the Semantic Web, to rethinking network protocol design. A pull-out program for the series is included with this issue of FOCUS.

Our cover story showcases the collaborative work of **Chad Bennington** (ChemBio), who explores novel methods for optimizing pulping processes.

Arnaud Doucet (CS/Stats) combines his statistical and computational expertise to extract meaning from large, complex data sets.

Ryozo Nagamune (ME) is developing robust control systems for hard disk drives, with potential application to other industries.

Using computer modelling, **Tor Aamodt** (ECE) modifies techniques used in graphics processing to improve performance in non-graphics applications such as scientific computing.

We hope you find this issue of FOCUS and the talks by our distinguished speakers inspiring.

Nimal Rajapakse, ICICS Director

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process, wood chips are first cooked in a chemical liquor to liberate the pulp fibres. The fibres are further delignified with oxygen, and then bleached. Various mixing operations blend different streams of pulp, mix in chemicals, and ensure uniform mass concentration flows to different processes.

Mixing quality, however, is rarely measured in mills, and when it is, it is often found to be poor. As Principal Investigator of an NSERC Collaborative Research and Development grant supported by seven pulp and paper companies, Chad Bennington, along with ICICS colleague Guy Dumont (ECE) and Fariborz Taghipour (ChemBio), is addressing this problem by developing various methods of predicting the dynamic performance of mixing chests. One such technique involves using particle image velocimetry to compare flow patterns in a lab chest with computer simulations, so that the models can be improved. Another uses electrical resistance tomography to measure the uniformity of fibre suspensions during and following mixing operations. "We're trying to understand how the many different mixers in a typical mill should be designed and operated," Bennington says, "and how efficient they are." Key factors such as the amount of power required to ensure complete motion of the pulp through a chest can then be incorporated into the design. Improved mixing uniformity also means less chemical use in subsequent operations, saving money and reducing pollution.

Going with the Flow

But the key to optimizing pulping processes would be knowing what really goes on inside the many vessels involved. As Bennington points out, "Since we're working with closed vessels we have to make inferences about what's going on inside them." Aware of a 1961 experiment in which radioactive chips were put through an industrial digester and tracked with a Geiger counter, Bennington had the idea of designing a SmartChip equipped with sensors to measure different parameters as the chip moves through the digester.

ICICS colleagues Mu Chiao (ME), Shahriar Mirabbasi (ECE), and John Madden (ECE), with respective expertise in microelectro-mechanical systems (MEMS), system-on-a-chip design, and power generation, thought it was a good idea, and so did NSERC, granting the group $403,700 in 2007 to develop the SmartChip. Howe Sound Pulp & Paper, Paprican (now part of FPInnovations), and SST Wireless are also supporting the project.

Previous experiments to measure reaction conditions inside a digester were applicable only to batch operations. Tests involved lowering baskets of chips to different levels in the vessel, cooking them with the batch, then pulling them up and comparing them. The SmartChip should provide a much more complete picture of the reaction by following the chip flow and recording real-time operating data, in both batch and continuous operations. Repeatedly passing the chip through the system will allow the team to build a comprehensive profile of the process. They will then be able to verify and improve their computational models and accurately simulate the effects of design changes on pulp quality.

The researchers are currently working on a hockey puck–sized prototype that will record temperature, pressure, and time. Following a series of lab and industrial tests, they will develop a much smaller system-on-a-chip version with additional sensors to measure parameters such as conductivity and chemical concentration. Plans are to have a small, robust, retrievable, reusable SmartChip available by 2010 that can be mass produced and used in other industrial reactors.

Canada produces 14% of the world's pulp. If the SmartChip leads to design improvements that increase productivity by even 1%, the effect on the industry in terms of reduced chemical use, energy consumption, and pollution will be profound. As Bennington says, "There's an opportunity here to make things a lot better, to save resources and make better pulp." All it takes is knowledge.

Chad Bennington can be reached at 604.827.3537 or cpjb@chml.ubc.ca

Tackling the Intractable

In computational statistics, researchers such as Computer Science/Statistics professor Arnaud Doucet, use mathematical theory and simulation-based methods to solve problems previously thought unsolvable.

▸ **Simulation-Based Techniques**
▸ **Monte Carlo Methods**
▸ **Stochastic Trees**

Computational statisticians are among the pre-eminent sleuths of the 21st century. Their job is to develop methods of mining and analyzing massive amounts of data now available through advances in data acquisition, storage and computation. New ICICS member Arnaud Doucet is developing statistical models to help derive knowledge from large, heterogeneous data sets, particularly high-dimensional data

such as microarray images or Web pages that combine audio, video and database information.

Improving Monte Carlo Methods

Monte Carlo methods are a class of computational algorithms in which random numbers are assigned to unseen or unknown variables in order to compute results. Their use is increasingly important for the optimization, integration and simulation of complex systems in bioinformatics, chemical physics, finance, architecture, photorealistic 3D-graphics, and film special effects.

Markov Chain Monte Carlo (MCMC) methods use a collection of random variables having the property that, given the present state, future states are independent of the past. "MCMC algorithms are good for working with high-dimensional data, dealing with missing data, or marginalizing nuisance parameters in order to make inferences or predictions about parameters of interest," says Doucet.

However, many problems in statistics and computer science cannot be addressed using MCMC methods, which are too cumbersome to handle massive data sets. Also, they cannot handle data that have to be processed on-the-fly, such as in medical imaging and high-definition streaming video.

"The problem with MCMC is that once you run your algorithm, you cannot incorporate new or additional data, or reuse previous data to obtain the new solution," Doucet explains. "You have to re-compute the whole thing from scratch."

Building on Previous Data

Sequential Monte Carlo (SMC) methods are a relatively new approach that uses a "divide and conquer" strategy for solving computational problems, allowing for the gradual updating of the system so that the main problem is solved by solving a sequence of smaller, easier problems.

A limitation of SMC techniques is that random or unknown variables can only be imputed (substituted) sequentially. Doucet has developed a new type of SMC framework that takes into account previous data in order to update variables in light of new data. The framework also allows the user to design algorithms with self-learning abilities.

Because of their sequential nature, SMC techniques are not efficiently implemented in parallel computing. Doucet is working

Designing for Precision and Robustness in Hard Disk Drive Control

Mechanical engineering professor Ryozo Nagamune applies robust control theory to hard disk drive systems and beyond.

▶ **Hard Disk Drives**

▶ **Track-following Precision**

▶ **Multiple Controllers**

Hard disk drives (HDDs) are ubiquitous, used in devices ranging from computers to video game consoles to cell phones. Mass production of HDDs, along with a trend toward miniaturization and increased storage capacity, are fueling the need for robust, high-precision designs. Ryozo Nagamune is working to meet this need.

Hard disk drives store information by magnetizing circular platters through a microscopic read/write head mounted on a suspension arm. Storage capacity is increased by increasing track density or decreasing track width, making already extremely tight tolerances much tighter. The servomechanism (servo) that positions the read/write head must therefore be very precise and robust, with high bandwidth.

Conventional head-positioning control in HDDs is governed by a single actuator and a position-error sensor that sends a signal to the controller based on a sampling rate. Structural resonance in the actuator, however, and a limited sampling rate, hamper the precision of the system. Designs incorporating a second actuator for fine-tuning and vibration compensation, and additional sensors for a higher sampling rate, have been proposed. However, they are based on classical control theory, which is suboptimal for such multivariable problems. To make an essentially good idea feasible, Nagamune, funded by NSERC and in collaboration with researchers at Berkeley, Samsung and Seagate, is developing novel design methodologies for these systems.

Nagamune is approaching the problem by being systematic. For example, his mathematical model takes into account the known mechanical characteristics of the suspension arm, which has not been done before. Also, instead of trying to account for all of the uncertainties introduced by multivariable systems, he will take a probabilistic approach that strikes a balance between computational complexity and uncertainty. Since head position error must be minimized at all times for high precision, not just when being sampled, Nagamune's system will also account for inter-sampling behaviour. Combined together, these and other techniques should produce a controller capable of the ultra high precision and robustness necessary in current and future HDDs. Nagamune plans to incorporate them into a software package after validating them experimentally. "This package," he says, "will help servo engineers who are

> "My long-term objective is to develop a universal robust servo design technique for control problems in a wide variety of applications."
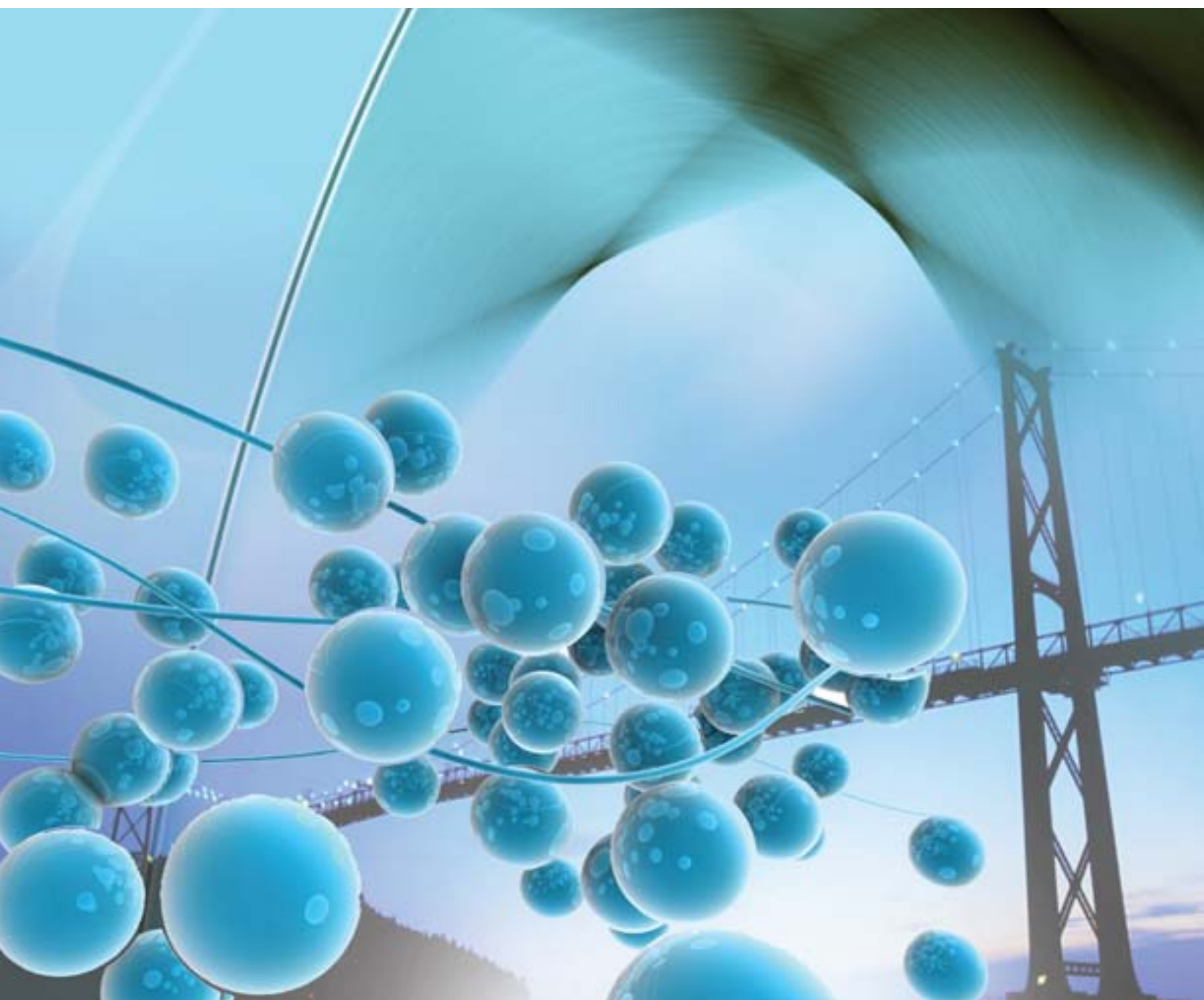
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1 October 23, 2008
Brain on a Chip:
If We Build One, What Will It Say?

Bruce C. Wheeler, University of Illinois at Urbana-Champaign

The wild idea that nerve cells grown in culture could have reliable computational function, while still a wild idea, is closer to reality than we might expect, thanks to applications of both engineering and applied biology. The combination of electronics, microlithography, materials science, neuroscience and advanced culturing techniques make possible the controlled growth, recording, and stimulation of nerve cells in a dish. What these neurons might be saying—their patterns of recorded electrical activity—is now gaining considerable attention as neural engineers struggle with data that is inherently very high dimensional and decidedly non-linear and non-stationary. This lecture will highlight the technologies that make possible designable "brains on chips," followed by both review and speculation as to how to interpret the signals in order to understand how neural information is being coded.

Bruce Wheeler will become a Professor of Biomedical Engineering at the University of Florida this fall. He has been a Professor at the University of Illinois in the Bioengineering Department, (which he founded and where he was Interim Head), the ECE Department (Associate Head), the Neuroscience Program (Chair of Program), and the Beckman Institute. He is a Fellow of the IEEE and the AIMBE, and serves as Editor-in-Chief of the *IEEE Transactions on Biomedical Engineering*. He received his BS degree from MIT and MS and PhD degrees in Electrical Engineering from Cornell. His research interests lie in the application of electrical engineering methodologies, including signal processing and microfabrication, to the study of in vitro nervous systems in order to better understand the behavior of small populations of neurons and, ultimately, the functioning of the brain.
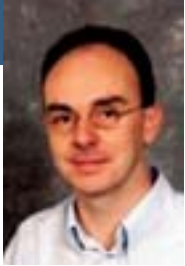
3 January 29, 2009
Managing Massive Interference

Helmut Bölcskei, Communication Technology Laboratory, ETH Zurich

The performance of many modern wireless communication systems is limited by interference. Managing this (often massive) interference is one of the major challenges in the evolution of wireless systems. This talk provides an overview of the associated information-theoretic performance limits and discusses several approaches to interference management on the system design level as well as on the signal processing and VLSI implementation levels.

Helmut Bölcskei is a Professor of Electrical Engineering at ETH Zurich, Switzerland. He received his MS and PhD degrees at Vienna University of Technology, Austria, was a post-doctoral researcher at Stanford University and then joined the faculty of the University of Illinois at Urbana-Champaign. He received the 2001 IEEE Signal Processing Society Young Author Best Paper Award, the 2006 IEEE Communications Society Leonard G. Abraham Best Paper Award, the ETH "Golden Owl" Teaching Award, and was an Erwin Schrödinger Fellow of the Austrian National Science Foundation. He has been a plenary speaker at several IEEE conferences and serves as an associate editor of the *IEEE Transactions on Information Theory*. His current research interests are in communication and information theory, signal processing and quantum information processing.

5 March 26, 2009
Designing IT Systems in Context

John Canny, University of California at Berkeley

The mix of computing and the everyday continues to surprise—not where we expected, e.g., smarthomes, but where we didn't, e.g., Twitter, iTunes and Flickr. Designing well in new contexts requires expertise well outside of traditional computer science. I will discuss our experiences with an interdisciplinary design lab (the BID Lab) at UC Berkeley and some of the research it produces. The talk covers two projects: a telepresence system called Multiview, which contradicts what we "knew" about video-conferencing and draws heavily upon social psychology and non-verbal communication; and MILLEE, a project for second-language learning on cell phones that exploits learning science. Both projects have benefited from deep domain expertise. I'll close with some of the lessons we have learned about interdisciplinary sustainability.

John Canny is a Professor in Computer Science at UC Berkeley. His 1987 PhD from MIT was in robotics, and won the ACM doctoral dissertation award. He then focused on the interaction between computers and the physical world—robotics, geometry, vision and computational biology. Since the 1990s he has concentrated on the democratization of computing, and what it means to design systems for the everyday. In 2002, he started the Berkeley Institute of Design, an interdisciplinary, human-centered design research lab that now houses 30 researchers from 8 departments. His research priorities are educational technology, IT for health care, persuasive technology, mobile HCI and CSCW. He won best paper prizes from ACM CHI 2007 and the Persuasive Technology Conference 2008. His project MILLEE was a winner in the MacArthur Foundation's Digital Media and Learning competition in 2008.

2 November 20, 2008
Autonomously Semantifying Wikipedia

Dan Weld, University of Washington

Berners-Lee's vision of the Semantic Web is hindered by a chicken-and-egg problem: how can one create enough structured data to motivate the development of applications? We argue that this bootstrapping problem is best solved by autonomously "Semantifying Wikipedia." We choose Wikipedia as an initial data source, because it is comprehensive, high-quality, and contains enough manually derived structure to bootstrap an autonomous, self-supervised process. We identify several types of structures that can be automatically enhanced in Wikipedia (e.g., link structure, taxonomic data, infoboxes, etc.), and we describe Kylin, a self-supervised, machine learning system that extracts facts from Wikipedia natural-language text and organizes them into an automatically induced taxonomic representation. Experiments show that Kylin has both high precision and recall—in one case equaling that of humans.

Daniel S. Weld is the Thomas J. Cable / WRF Professor of Computer Science and Engineering at the University of Washington. He received bachelor's degrees in both Computer Science and Biochemistry at Yale University in 1982, and a PhD from the MIT Artificial Intelligence Lab in 1988. He received a Presidential Young Investigator's award in 1989 and an Office of Naval Research Young Investigator's award in 1990, and was named an AAAI Fellow in 1999 and an ACM Fellow in 2005. In addition, Weld is Venture Partner at the Madrona Venture Group and an active entrepreneur, having co-founded Netbot Incorporated (creator of Jango Shopping Search, acquired by Excite), AdRelevance (acquired by Media Metrix), and Nimble Technology (acquired by Actuate).

4 February 26, 2009
Folklore of Network Protocol Design

Radia Perlman, Sun Microsystems

Network protocol design is not a nice, clean science, where what gets deployed is the best possible design. Instead, designs are influenced by issues such as politics, general confusion, and backward compatibility. Statements get made, and repeated, until it never occurs to anyone to question whether they're true. Mistakes get made, and rather than backing up and fixing them, kludges are introduced to make things sort of work. This talk discusses interesting bad protocol designs that have been standardized and/or deployed, and how some of the odder things we live with (e.g., bridges) came about.

Radia Perlman is a Fellow at Sun Microsystems. She is known for inventing the spanning tree algorithm used by bridges/switches in today's networks, as well as the fundamental algorithms that make link state protocols robust and scalable. Her current research interests include assured delete, making large networks robust against Byzantine failures, and replacing bridges/switches with technology that is upwardly compatible, but more robust, flexible, and scalable. She is author of *Interconnections: Bridges, Routers, Switches, and Internetworking Protocols*, and coauthor of *Network Security: Private Communication in a Public World*, which are widely used both as textbooks in universities and by engineers learning the field. She holds over 90 patents, a PhD in computer science from MIT, and an honorary doctorate from KTH, the Royal Institute of Technology, Sweden. She was recently given a lifetime achievement award by Usenix, and named SVIPLA (Silicon Valley Intellectual Property Law Association) Inventor of the year.

**Lectures are free & are held from
3:30 p.m. to 5:00 p.m. in Room 2020/2030,
Kaiser Building, 2332 Main Mall, Vancouver, BC.**

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**Institute for Computing,
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UBC's Institute for Computing, Information and Cognitive Systems (ICICS) is an umbrella organization that promotes collaboration among researchers from the faculties of Applied Science, Arts, Commerce, Education, Forestry, Medicine and Science. ICICS supports the collaborative computer-oriented research of more than 170 faculty members and over 800 graduate students in these faculties. Reaching out to business and industry, ICICS provides creative solutions to diverse practical problems, including the development of interactive visualization of complex systems; video synthesis and authoring tools for multimedia; haptic displays; telerobotic system agents; automatic control of drug delivery; data mining; active Internet; wireless networks; and pervasive computing. ICICS researchers attract approximately $18 million in annual grants and contracts. Their work will have a positive impact on us all in the future.

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Making Use of More Transistors

Computer architect and Electrical and Computer Engineering professor, Tor Aamodt, is working to translate improvements in semiconductor technology into better performance at lower cost.

▸ **Graphic Processing Units**
▸ **Parallel Processing**
▸ **Multiple Core Architecture**

The ability to integrate hundreds of cores, or processors, onto a single chip is providing ICICS member Tor Aamodt with unique opportunities and challenges. While performance continues to improve for individual processor cores, the more rapid improvement in graphics hardware performance is attracting growing interest.

Graphic processing units (GPUs) are among the largest semiconductor devices in terms of the number of transistors used. The latest industry benchmark for GPUs is 240 cores on a single chip. By comparison, most central processing units (CPUs) in desktops, notebooks and server computers have only two to four cores. Aamodt uses computer modelling to design GPU-like hardware that utilizes hundreds of cores to accelerate non-graphics applications.

Improving GPU Efficiency for Scientific Applications

Current GPUs are primarily designed for high-resolution graphics and video streaming applications where pixels are drawn and coloured to create images. Although GPUs can draw billions of pixels per second, graphics software that runs on GPUs does not require evaluating many control-flow operations (e.g., "if/then" statements). More complex non-graphic applications such as scientific computing often require control-flow operations, which decrease GPU performance. Aamodt and student Wilson Fung have simulated hardware changes that show a 20 to 40 percent increase in efficiency versus current GPUs when running non-graphics applications that require control-flow operations.
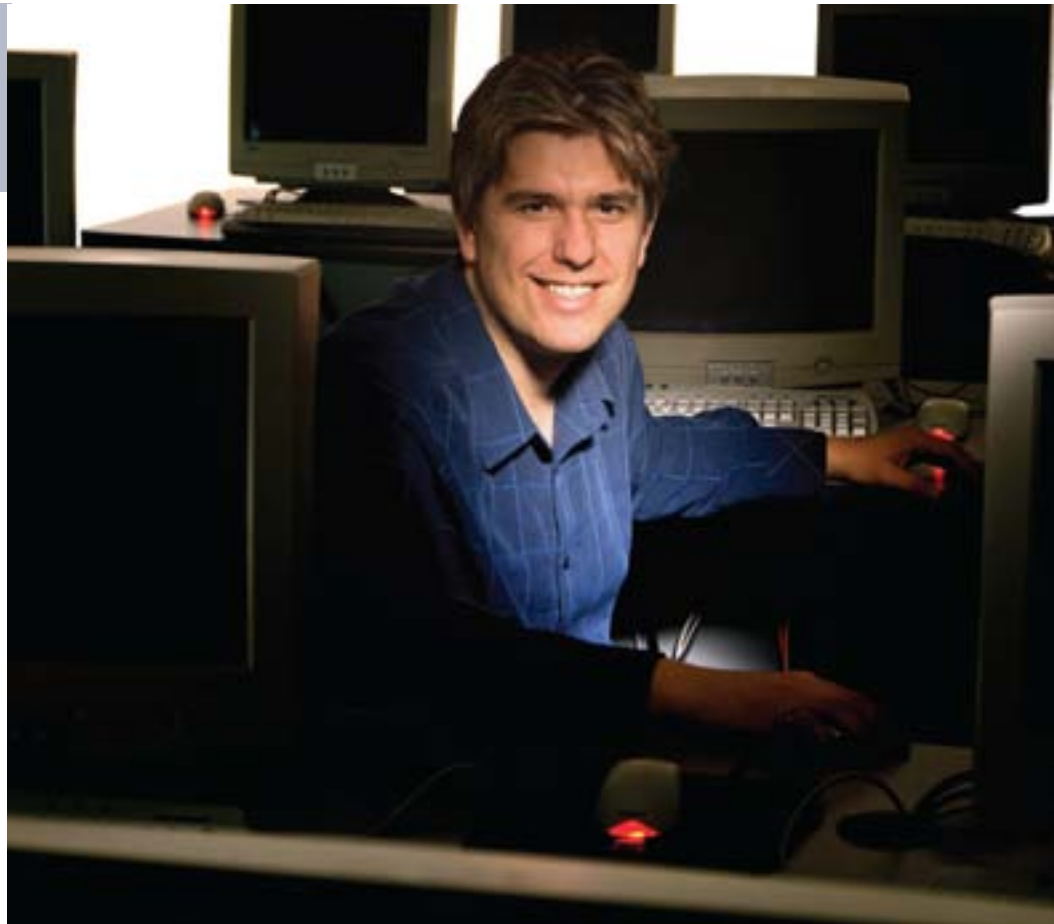
Cost-Effective Supercomputing

In parallel computing, large or complex problems can be divided into smaller problems and solved concurrently. Examples of non-graphics applications for GPUs include molecular dynamics, tomographic reconstruction, weather prediction, and stock option pricing.

"The graphics industry started with a very different approach to designing hardware," says Aamodt. "Graphics applications have a lot of inherent parallelism since they involve working with pixels, which can be processed independently." Graphics processors today are becoming more programmable, leading

Post-Silicon Debugging

Even after the most rigorous testing, bugs in chip design are often not caught until the hardware is fabricated. Debugging at this stage is time-consuming and extremely costly. Tor Aamodt's most recent research aims to bring new chips to market more quickly. With funding from Semiconductor Research Corporation, Aamodt is working with ICICS colleagues Alan Hu (CS, project leader), Steve Wilton (ECE) and André Ivanov (ECE), to apply formal verification techniques in order to find design bugs more quickly.

to implement SMC techniques on parallel computers to take advantage of their speed and efficiency.

Growing Stochastic Trees

Stochastic trees are statistical models used in many fields of research, including evolutionary and population genetics, machine learning and medical statistics.

In all of these areas, practical problems are characterized by a large amount of observable information and a scarcity of specific relational information among data types.

Doucet is investigating new computational techniques for inferring tree structures used in statistical analysis of these models. He and ICICS colleagues Nando de Freitas (CS) and Kevin Murphy (CS/

Stats) plan to use these methods in machine learning and computer vision applications. "All of my research involves applying complex algorithms in a clever way to complex statistical models that now have applications in almost every area of science and technology," Doucet says.

Arnaud Doucet can be reached at 604.827.3133 or arnaud@cs.ubc.ca

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unfamiliar with control theory develop robust control systems suitable for the disk drives they are designing."

Adding Controllers for Robustness

Dynamics variations in HDDs due to manufacturing irregularities, temperature changes, and wear are unavoidable. To achieve track-following precision across a vast batch of disk drives despite these variations, Nagamune is proposing the use of multiple controllers. His approach is to

represent the entire set of conceivable batch HDD dynamics as a set of parameters, then divide it into subsets based on uncertainty regions. The controller appropriate to that subset will then be assigned to disks with the corresponding dynamics, keeping track-following precision high.

But Nagamune's vision extends beyond hard disk drives. "My long-term objective," he says, "is to develop a universal robust servo design technique for control problems in a wide variety of

applications." Possibilities include control of automobile engines and of information flow in computer networks. Nippon Steel Corporation sees a possible application in steel rolling. Closer to home, ICICS colleague Yusuf Altintas (ME) is looking at applying Nagamune's work to machine-tool control, and Boris Stoeber (ICICS/ECE) to control of micro-electromechanical systems (MEMS).

Ryozo Nagamune can be contacted at 604.827.4344 or nagamune@mech.ubc.ca

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to a growing interest in using them to accelerate non-graphics software more cost-effectively than is possible using traditional processors.

Improving Multi-Core Design

Many of the programs that consumers interact with today were not designed for parallel platforms. "Server applications that process independent transactions can easily take advantage of today's advances in parallel computing hardware," says Aamodt. "But it is more challenging for applications such as a Web browser or word processor to

make effective use of multiple cores."

Even if each application on a PC used a different core, most people run a relatively limited number of applications. And, since many existing software applications can make good use of only a single core, the increase in performance for multi-core processors is limited without difficult changes to software.

"Increasing the number of cores on a chip while making each core identical is not necessarily the best way to use the additional transistors Moore's Law provides," Aamodt notes. He and student Henry Wong have been working with researchers at Intel to explore heterogeneous multi-core designs

including cores of varying size and performance, which may allow for more energy-efficient computing by matching performance to application demands.

"Moore's Law has defied the odds for a long time, and current industry projections suggest there are many years of technology scaling left," says Aamodt. "However, if and when nanotechnology, quantum computing or some other approach replaces transistors, there will be a need for computer architects to figure out how to put these new building blocks together into large-scale systems."

Tor Aamodt can be reached at 604.827.4116 or aamodt@ece.ubc.ca

ICICS Researcher Awarded Major Defense Research Contract

Vikram Krishnamurthy (ECE), has been awarded a Defense Research and Development Contract worth $304,000 over 4 years to work on Sensor Resource Management. The project deals with the stochastic control and management of complex sensors such as airborne surveillance radar. The goal is to develop efficient sensor scheduling and management algorithms for joint radar resource management and target tracking.

Boeing Grant for Visual Analytics Research

A 5-year $1.35 M grant from Boeing will put a team of researchers led by John Dill (SFU), **Brian Fisher,** (MAGIC/SFU) and **Ron Rensink** (CS/Psychology) at the forefront of the emerging field of visual analytics. The team will focus on integrating the perceptual and cognitive sciences with data visualization techniques so that governments, industry and academia will be better able to cope with an increasing flood of information.

NSERC Discovery Accelerator Supplement for ICICS Researcher

James Olson (ME) has received an NSERC Discovery Accelerator Supplement of $60,000 over 3 years to support his NSERC-funded study, "Modeling the Behaviour of Turbulent Fibre Suspensions." Olson is working to improve the energy efficiency of papermaking and pulp processing equipment by developing a fundamental understanding of the turbulent fibre suspensions involved. NSERC Accelerator Supplements target 50 outstanding researchers in Canada poised to make significant breakthroughs in their fields.

CFI LOF Grant for ECE Researcher

Hybrid control theorist **Meeko Oishi** will use a $191,935 CFI Leaders Opportunity Fund grant supported by BCKDF to set up a smart wheelchair testbed. This research is part of an ICICS collaboration to develop a "smart" robotic wheelchair that will help increase mobility for the disabled and elderly. Oishi also recently won a 2008-09 Early Career Scholar award from the Peter Wall Institute for Advanced Studies.

CS Student's Thesis Best in Canada

Wolfgang Heidrich's student Abhijeet Ghosh has won the 2007 Alain Fournier Thesis Award for the best computer graphics–related PhD thesis in Canada.

ECE Professor Appointed Canada Research Chair

Kenichi Takahata has been named a new Tier II Canada Research Chair in Advanced Micro/Nanofabrication and MEMS (micro-electromechanical systems). Takahata focuses on advanced methods for micro/nanofabrication and application to MEMS with wireless interfaces for biomedical and other applications.

Former ICICS Director Named YWCA Woman of Distinction

Rabab Ward (ECE) has been named a YWCA Woman of Distinction in the category of Technology, Science and Industry. The award recognizes Rabab's work in creating new roles and opportunities for women in the applied sciences, and her accomplishments as a world leader in the application of signal processing theory to cable and high-definition TV, breast cancer detection, and medical and voice signals.

Killam Prizes for ECE Researchers

Shahriar Mirabbasi received a UBC Killam Teaching Prize during the 2008 convocation. UBC's highest teaching distinction, these prizes are awarded annually from the Killam Endowment Fund to faculty nominated by students, colleagues, and alumni in recognition of excellence in teaching. Students consistently appreciate the rich learning environment Shahriar establishes for his courses.

Lutz Lampe has been awarded a UBC Killam Research Prize in the Science Category. Lampe's work on digital communication systems has lead to faster data processing, higher data rates and stronger system performance. He has made important contributions to coding and modulation theory as well as analysis and design of ultra-wideband wireless communications.

McDowell Award Winner

Karon MacLean (CS) has been selected as the recipient of this year's Charles A. McDowell Award for Excellence in Research. This award is given annually to a UBC faculty member who has completed their PhD within the last 12 years, for excellence in pure or applied scientific research. Professor Emeritus Charles McDowell was head of the Chemistry Department from 1955 until 1981.

Kellogg Booth's Achievements Recognized

The Canadian Human Computer Communications Society (CHCCS), a non-profit organization dedicated to advancing research and education in computer graphics, visualization and human-computer interaction (HCI), has selected **Kellogg Booth** (CS) as recipient of its 2008 Achievement Award. Kellogg is known for his long-term dedication to interdisciplinary research in these fields, and for his leadership in shaping the landscape of Canadian computer graphics and HCI research.

Governor General's Gold Medal Award for ECE Student

Master's student Colin Doutre, supervised by **Panos Nasiopoulos** (ECE), has been awarded the 2007 UBC Governor General's Gold Medal. This prestigious award is given to the UBC graduate student who has achieved the most outstanding academic record in the Master's program with thesis. Doutre's thesis is entitled, "Improvements of Demosaicking and Compression for Single Sensor Digital Cameras."

Achievement Award for Former CS Head

As department head, **Bob Woodham** worked hard to increase the number of faculty, students, and staff resulting from the province's "Double the Opportunity Initiative," and to build the addition needed to accommodate this growth. His efforts on behalf of the department were recognized recently when he received a Faculty of Science Achievement Award for Service.

New ICICS Canadian Academy of Engineering Fellows

ECE professors **Peter Lawrence** and **Victor Leung** have been elected Fellows of the Canadian Academy of Engineering. The Academy is a learned society of professional engineers from all disciplines who are elected Fellows on the basis of their distinguished service and contribution to the society, the country, and the profession.

Bessel Research Award for ECE Researcher

Robert Schober has received a Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation. The award is for science researchers who have completed their doctorates within the last 12 years and are expected to continue producing influential work. Award winners are invited to spend up to one year collaborating on a long-term research project with colleagues at a research institution in Germany.

Passing Notes:

ECE Professors Receive NSERC Strategic Project Grant Awards

Edmond Cretu, Shahriar Mirabbasi, Robert Rohling, and **Tim Salcudean** have been awarded $194,730 over two years for their project, "Ultrasonic Medical Imaging System Using Capacitive Micromachined Transducer Array." The research aims at developing a medical imaging system for use in a low-cost, high-performance portable ultrasonic system for breast cancer diagnosis and monitoring.

Sidney Fels has been awarded $200,000 over 2 years to explore a new class of 3D display technology that arranges multiple 2D flat panel displays into a geometric shape for viewing and controlling reactive 3D scenes from different perspectives. Fels is creating a lightweight, wireless, display prototype for user evaluation.

Sidney Fels is also co-investigator on a 2-year, $188,000 grant with Rodger Lea (MAGIC) and **Buck Krasic** (CS) entitled, "Public Screens and Personal Interaction." The team will be creating an open-source communication infrastructure to support interaction with large public display screens through hand-held devices such as cell phones or PDAs.

Vikram Krishnamurthy and **Victor Leung** have been awarded $199,998 over 2 years to investigate "Dynamic Resource Allocation for Uplink Packet Access in High-Speed Cellular Wireless Networks." The project focuses on achieving broadband connectivity in uplink-intensive data and multimedia services for cellular access networks. Industrial collaborators include Sierra Wireless, Telus, Dyaptive Systems, and MIMOW Technology.

Multiple-input multiple-output orthogonal frequency division multiplexing (MIMO-OFDM) technology is seen as the future enabler of high data-rate, high-quality, high-mobility wireless communication. **Lutz Lampe** and **Robert Schober** have been awarded a $191,045, 2-year grant to address some of the major remaining problems with the technology. Their project is supported by Sierra Wireless and Bell Canada.

Schober is also co-investigator with Henry Leung (Univ. of Calgary) on the project "Integrated Sensor Fusion and Communication for Multi-Platform Sensor Networks," awarded $195,905 over two years. The researchers aim to develop a self-adaptive sensor network with a long lifetime and robustness to frequent topology changes. The research will have application in remote-monitoring sensor networks and defense and security surveillance.

Guy Lemieux and **Steve Wilton** have been awarded $190,000 over two years for their project, "Computational FPGA Architecture and CAD Tools." Field-programmable gate arrays (FPGAs) are generic logic chips used in a wide range of applications, including PDAs, cellular phone base stations, Internet routers, and medical instruments. This research will investigate new FPGA architectures that directly operate on words, making FPGAs more efficient at data processing, and simplifying hardware design techniques.

Wireless local area and mesh networks are widely used to provide wireless Internet access. **Vincent Wong** and Jiangchuan Liu (SFU) have been awarded $184,000 over two years to develop advanced technologies and systems for monitoring these networks. The research should lead to reduced network deployment and management costs, and improved service availability. It is supported by Nokia and Novax Industries Corporation.

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