Professor fights 'brain drain' while advancing computer design

BY YVONNE LUND

We hear a lot about the so-called "brain drain" these days — Canada's best and brightest minds leaving for the money and opportunities of the U.S.

Although media reports paint a dismal picture, there is still a cadre of world-class researchers who call Canada home. The University of Victoria, for example, is fortunate to have many fine scientists who are quite happy to stay in Canada.

In the computer science department, Dr. Micaela Serra is one who has made a conscious choice to live and work in Canada. Serra is an internationally known expert in fault-tolerant testing for computer chips — used in developing stable and robust computer components.

She is also an outspoken advocate for women in computer science. Originally from Italy, Serra earned her degrees at the University of Manitoba and UVic. In 1987, she became the first female faculty member in UVic's computer science department.

Although many in her field have emigrated to Silicon Valley or Redmond, Serra feels a sense of obligation to the taxpayers of Canada. "I am very aware that taxes — my taxes — are paying for my research," she says.

It's a sense of obligation her students seem to echo. Most of Serra's graduate students — even the exchange students — spend at least a few years in Canada, returning the value of their taxpayer-subsidized education through innovative technological research.

Supported by grants from the Natural Sciences and Engineering Research Council (NSERC), Serra and her graduate students have been conducting research on hardware-software co-design since 1994. This relatively new specialization encompasses some of the most ground-breaking research in computer science today. Instead of slow programs (the software) telling the fast machine (the hardware) what to do, this emerging field blurs the line between program and machine, resulting in faster configurations that are cheaper to produce and easier to customize.

Most research on hardware-software co-design has focused on its use in embedded systems — the miniature computers that run everything from your car's fuel system to your microwave oven. "There are up to 1,000 microcontrollers or microprocessors in an average household," notes Serra, "and these implementations are based entirely on hardware-software co-design principles."

In addition to embedded systems, hardware-software co-design is used to develop chip accelerators for power-hungry processes such as graphics cards,
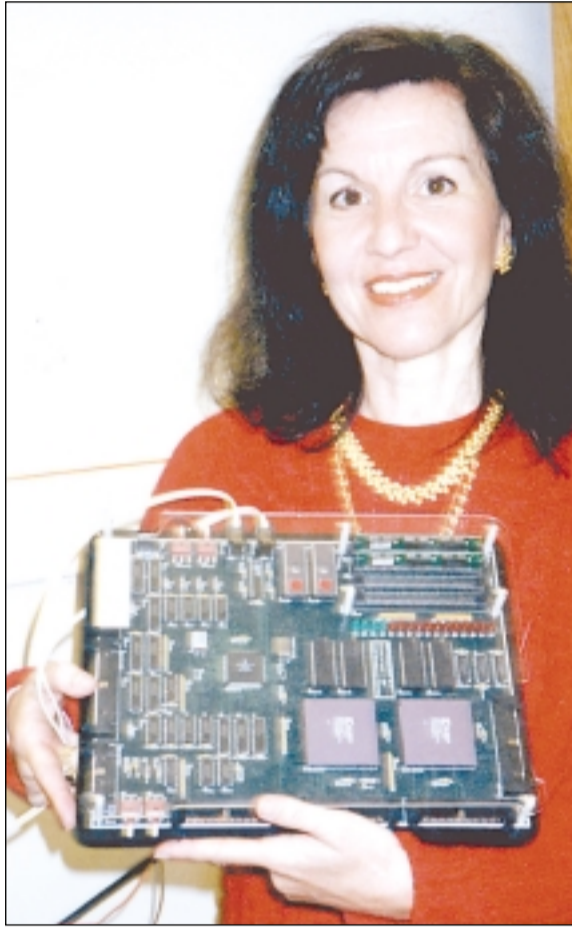
Serra with a reconfigurable hardware circuit board, donated by the Canadian Microelectronics Corporation and used in her research in hardware-software co-design.

games and video boards.

Serra and her students also act as co-design consultants for local technology-based industry. One local company uses specialized digital signal processing and microprocessors to develop digital audio products for the professional/commercial music industry. Another works with the ever-widening field of "smart card" technologies. A smart card — which is like a credit card with an embedded computer chip — can acquire, store and use both cash and data. Popular in Europe for everything from transit cards to medical records, their use here is expected to skyrocket in the next few years.

Whether used for smart cards, embedded systems or chip accelerators, hardware-software co-design is part of the leading edge of today's technical applications — and Serra's work with hardware-software co-design proves Canada's "undrained" brains can make a significant contribution to tomorrow's technological discoveries and innovations.

Socially responsible computer science education

Micaela Serra sees teaching computer science as much more than helping students grasp the basic technological concepts and achieve a passing grade.

"These students may be going on to do programming for intensive-care-unit heart monitors or nuclear power plants," she says. "So it's important that they learn more than the basics and understand the social responsibility involved in implementing technology.

"In my undergraduate classes, I include discussions of technology and the law, technology and women, ethics and copyright matters."

Much of her own research and that of her graduate students is involved in designing and testing computer hardware and software for reliability.

"When your word processor doesn't work right, it's an annoyance," she says. "But if your pacemaker is not reliable, that's a matter of life and death."

SHARPEN YOUR KNOWL EDGE

• The first computer programmer was a woman — Lady Augusta Ada Lovelace, daughter of the poet Lord Byron — who worked with British mathematician Charles Babbage on his "analytic engine" calculating machine in the mid 1800s.

• In the early 1950s, Grace Hopper in the U.S. pioneered the use of compilers, which translate programs into machine language so they can be executed. She also helped develop the COBOL programming language and contributed to the UNIVAC computer project.

• Biographies of Lovelace, Hopper, and 14 other women of science are posted on the San Diego Supercomputer Centre Web site: <http://www.sdsc.edu/ScienceWomen/>.

• Micaela Serra was awarded this year's Victoria YM-YWCA Women of Distinction award in the science, technology and environment category for her work in encouraging women to enter the field of computer science. Her Web site contains numerous links to further information on women in science, engineering and mathematics: <http://www.csr.uvic.ca/~mserra/women.html>.

• UVic's Women in Science and Engineering group works to inspire and support women in these fields. Their Web site is: <http://www.engr.uvic.ca/~wise>.

EDGE/WISE

Brain drain/brain gain?

On May 24, Stats Canada released a study showing that, during the 1990s, the loss of highly skilled workers to the U.S. accelerated, but so too did the influx of highly skilled workers into Canada from abroad. The picture is far more complex than that of a simple loss of workers in knowledge-based occupations. Details are available on the Stats Canada Web site: <http://www.statcan.ca/Daily/English/000524/d000524a.htm>.

Surrounded by computers

Computers are a lot more than the hunk of plastic that sits on your desk. Tiny embedded computer chips that control a mind-boggling variety of appliances make up 92 per cent of the chip market. They are in cardiac pacemakers, diabetes self-test kits, carbon monoxide detectors, nursery monitors, thermostats, and thousands of other familiar — and sometimes life-sustaining — devices.

FACTS FROM THE EDGE

• B.C.'s first "high-performance computing facility" was installed recently at UVic. Some 200 times as powerful as the top personal computer, it will be used for research in which UVic scientists and engineers are internationally recognized — the study of the evolution and formation of galaxies, high-energy physics, climate modelling, DNA sequencing, electromagnetic fields, electronic fault detection, mechanical engineering and computer hardware design.

• In 1998, UVic established its extremely popular software-engineering program to help address a major shortage of software professionals. The shortfall is not surprising: Software that runs a telephone switch today requires 30 million lines of programming code; ten years ago, programs with millions of lines did not exist.

ON THE EDGE OF YOUR SEAT

Transforming Conflict Using Ritual and Imagination,
June 14, 12:30 p.m.
A lecture by Michelle LeBaron, associate professor of conflict analysis and resolution, George Mason Univ., Virginia. Begbie Bldg., Room 158. Info: 721-8777.

Japanese Noh Theatre
June 17, 8 p.m.
Lecture/demonstration of Japan's highly stylized classical theatre by the distinguished Sakurama Makoto of the Komparu School of Noh Theatre, accompanied by fellow actor Hase Iichiro and two musicians. Phoenix Theatres. Tickets $15. Reservations and info: 721-8003.

Dragonflies of Local Wetlands
June 22 (lecture) 7–9 p.m.,
June 24 (field trip) 11 a.m.–3 p.m.
Led by dragonfly expert Gord Hutchings. $42.80. Registration required. Phone UVic Continuing Studies at 721-8481.

SUB Open House Party
July 5–7, 11 a.m.–6:30 p.m.
UVic Students' Society welcomes the community with live music, barbecue, beer gardens, craft vendors, summer book sale, wacky Zap photocopy T-shirts, a laser tag tent and more. Outside Student Union Bldg. Info: 472-4309.