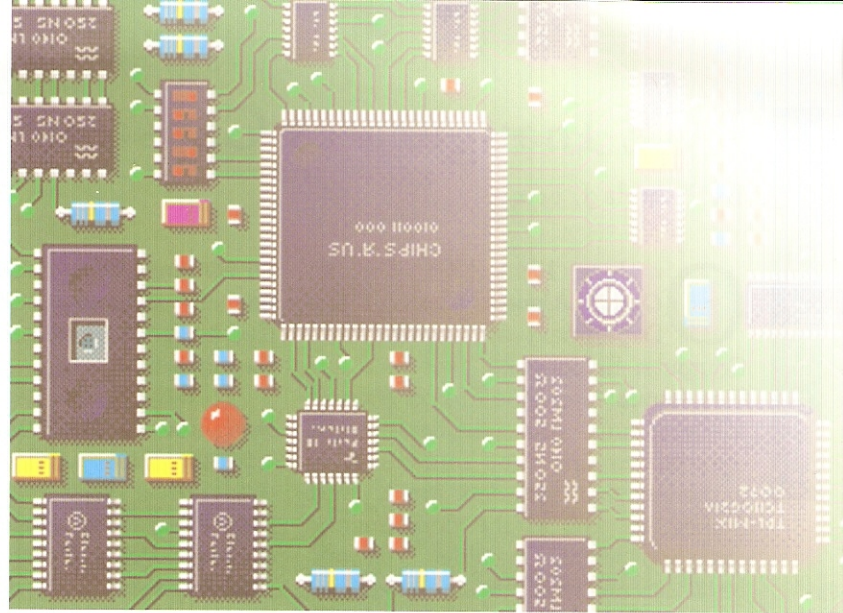# Concordia Group helps Pioneer System-on-Chip Research

By Scott McRae

Concordia's Hardware Verification Group from the Department of Electrical and Computer Engineering is making waves with its microelectronics systems research, and recently received a torrent of interest and accolades at a major industry meeting.

The "ACM/IEEE Design Automation Conference" (DAC), the premier electronic design automation and silicon solution event, was held last June in San Diego. Not only was the 2004 convention the largest ever, with over 11 000 delegates attending, it featured the inaugural North American SystemC Users Group meeting, including a prominent talk by Concordia Research Chair, Hardware Verification Group founder, and associate professor **Dr. Sofiène Tahar**.

SystemC is a revolutionary new system specification language which builds on recent advances in microelectronics systems–from processors, memory and advanced operating systems through to sensors and networking–which can now be integrated onto a single chip, known as the System-on-Chip (SOC). SOC technology requires a design language, or System Level Language (SLL), which can communicate with both software and hardware. In this regard, SystemC is one of the most relevant SLL proposals and has become an industry standard, adopted by more than twenty thousand users worldwide.

However, the language is in its infancy and still has a great need for good verification tools and techniques. Here, Concordia is making a major contribution to this emerging field. Alongside presentations at the Design Automation Conference by Intel, Qualcomm, STMicroelectronics and Sun Microsystems, Dr. Tahar, of the Hardware Verification Group, gave a talk on Assertion and Model Checking in SystemC.

"The more a system becomes complex," said Dr. Tahar, "the more likely there will be bugs and the more there is a need for verification. This is the main focus of the Hardware Verification Group." The group uses four different techniques for verification: simulation, model checking, assertion-based verification and theorem proving. While most people working on SystemC come from a hardware background and approach verification from that angle, one of Concordia's principal innovations was to convert code into the Abstract State Machines (ASM) language, which can be checked and tested by a powerful Microsoft Research language used for software (ASMLT tool). "Although this approach was met with surprise by many at the conference," said Dr. Tahar, "it works because SystemC breaks down the hardware/software distinction".

The Hardware Verification Group, which also includes assistant professor **Otmane Ait Mohamed**, research associate **Yassine Mokhtari**, ten PhD students, six Masters students, and a postdoctoral fellow, has been richly rewarded for its work. The Canadian R&D director of STMicroelectronics, Europe's largest electronic design automation company, made a special visit to Concordia to meet with the group two weeks after the Design Automation Conference to discuss potential collaboration and funding opportunities. Concordia has been selected to host and manage the official North American SystemC users' web site. Dr. Tahar was also invited by the director of Kluwer Academic Publisher to contribute to a book on SystemC design and verification, and by the IEEE Design and Test Journal editor to contribute to a special issue on System Level Design. He was also invited by the Canadian Microelectronics Corporation (CMC) to be a keynote speaker on the same subject at the "Canadian Workshop on System-on-Chip" in Banff last July. In the meanwhile, Dr. Tahar became a member of the Steering Committee for the North American SystemC Users Group, which draws 90% of its membership from US industry, and was appointed Program Chair for their meeting which took place in Santa Clara, California, in September 2004.

Considered one of the pioneering universities in Canada and North America doing research on SystemC, Concordia's contribution has been well recognized. "We're working in an area that is very much in demand," said Dr. Tahar, "and our group is pretty known worldwide". For more information on the Hardware Verification Group at Concordia, visit the Web site: http://hvg.ece.concordia.ca