

Title: FPGA Technology for Renewable Energy Systems – State of the Art and Trends.

Speaker: Prof. Rachid Beguenane, Royal Military College of Canada

Duration: 90 minutes

Abstract:

The implementation of complex algorithms in non-reconfigurable software-based Digital Signal Processors (DSP) results in poor performance. In addition, DSP chips are difficult to meet the cost, size, and power consumption demands. As long as the market volume is justified, Application Specific Integrated Circuit (ASIC) is the solution to get fast performance. But designing an ASIC in today's deep submicron geometries is harder than ever, and the problems continue to worsen with shrinking geometries. Using Field Programmable Gate Arrays (FPGA) devices, as an alternative method to implement complex algorithms, leads to a better compromise between the flexibility of DSP and the computation power of ASIC chips. From mid 90s, FPGA technology has significantly evolved and allowed the implementation of digital signal processing algorithms. As a result, it has been introduced in industrial motion control systems, which are at the heart of renewable energy systems, because of the ever-increasing level of expected performance while reducing the cost of the controllers. In fact, given their potential parallelism, FPGA-based motion controllers can take only a small fraction of the power drive's switching period to execute in real-time any complex control algorithm. Such immediate feedbacks make them very close in their behaviours to their analog counterparts, leading though to an improving performance while benefiting from all the advantages of digital devices, such as reliability, flexibility, insensitivity to component variations, and noise immunity. Exploiting the benefits of FPGA technology for renewable energy systems has been the source of many research investigations during last decade in order to boost their performances at lower cost. The tutorial will dress the state of the art of FPGA technology used for renewable energy systems, the associated design tools, the main industry players in the field and the future research trends in order to build a powerful and complex motor/converter control devices. Various case studies will be presented during the tutorial that will cover practical aspects of FPGA-based renewable energy systems.

Biography:

Dr. Rachid Beguenane received his D.E.A. and Ph.D. degrees, both in electrical engineering from CNAM, Paris, France in 1991 and 1994 respectively. During this period, he conducted his Ph.D. research work at École des Mines de Douai, France. From 1995 to 1997, he held a teaching and research position at the Professional Institute of Amiens, France. During 1997/1998, he was a post-doctoral researcher at the School of Information Technology and Engineering of the University of Ottawa, Canada. From 1998 to 2002, he has been employed as ASIC/FPGA design engineer by Telexis inc., Nortel Networks, and Prova Scientific Corp. in Ottawa and Montreal, Canada. He mainly designed and verified IC chips for telecommunication industry. From 2002 to 2009, he was associate professor at Université du Québec à Chicoutimi (UQAC), Canada. Since 2009, he is associate professor in electrical and computer engineering department of Royal Military College of Canada. Dr. Beguenane has authored and co-authored more than 60 technical papers.