Intervenant : **Pierre Collet, University of Strasbourg**

TItre: **Artificial Evolution : a Complex System that can efficiently exploit massively parallel computing eco-systems to solve inverse problems with EASEA**

Abstract:
With the advent of GPGPU cards, all computers are becoming massively parallel systems that are very difficult to program efficiently. Indeed, the last generation of NVIDIA cards (GTX690) provides 3072 cores grouped into multi-processors of 32 SIMD cores. This means that in order to efficiently execute an existing algorithm on a single PC with a hexacore CPU and a top notch GPGPU card, one should decompose the algorithm into 6 major tasks and 3072 minor ones which, 32 by 32, should execute the same instruction at the same time!

Super-computers are currently created by putting together thousands of such machines (TSUBAME 2.0, 5th machine in the Nov 2011 top 500 super-computer ranking is made of 1442 nodes containing 3 GPU cards each) but because of necessary synchronizations between cores and data exchanges, exploiting efficiently such machines (standard PCs with GPU cards, clusters of GPU PCs, GPU super-computers) is virtually impossible with standard top-down algorithms.

Fortunately, Complex Systems produce results that emerge from the multi-level interaction of many independent entities that can be directly implemented in a very efficient way on multi-level massively parallel machines or computing eco-systems (made of potentially heterogeneous computers, clusters, grids, clouds, super-computers) allowing to use exascale computing facilities in an efficient way.

This talk will show how Evolutionary Algorithms (that implement a complex system) can be ported on such computing eco-systems in order to optimize nearly any kind of continous, discrete, combinatorial, or mixed problems thanks to the EASEA-CLOUD massively parallel evolutionary computing platform.

Biography:

After a PhD in obtained 1997 in virtual reality for rhinology, Pierre Collet joined INRIA from 1998 to 2000, where he developed the EAsy Specification of Evolutionary Algorithms (EASEA) language. He then worked at French Ecole Polytechnique, as a researcher for the European DREAM project, that used EASEA as a programming language. After several years as associate professor at Université du Littoral, he was appointed full professor at Université de Strasbourg in 2007, where he leads the BFO (theoretical bioinformatics, data-mining and stochastic optimization) team of the ICUBE laboratory. In 2011, he was appointed Head of the department of Computer Science of the Strasbourg University and is currently coordinating the Strasbourg Digital Campus on Complex Systems. He was also elected as member of the council of the Complex System Society. The EASEA language has now become a parallelization platform, that was quoted in a Science paper for its contribution to the finding of a new zeolite crystalline structure and that recently won the GPUs for Genetic and Evolutionary Computation competition at GECCO'12. A $500K research project called EASEA-CLOUD started in 2012 to port EASEA on the Grid and on the Cloud.