# Editorial

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Parallel computer architectures and bioinspired algorithms (BAs) have been coming together during the last years. On one hand, the application of BAs to solve difficult problems has shown that they need high computing power and communications technology. Parallel architectures and distributed systems have offered an interesting alternative to sequential counterparts. On the other hand and perhaps which is more interesting for the computer architecture community, BAs comprises a series of heuristics that can help to optimise a wide range of tasks required for parallel and distributed architectures to work efficiently. Genetic algorithms (GAs), genetic programming (GP), ant colonies algorithms (ACO) or simulated annealing (SA) are nowadays helping computer designers on the advance of computer architecture, while improvement on parallel architectures are allowing to run computing intensive BAs for solving other difficult problems. We can find in the literature several evolutionary solutions for circuit design problems such as partitioning, place and route, etc., which allows technology improvements. Researchers have also used this kind of meta-heuristics for the optimisation of computer architectures, balancing computer load, instructions code and other related problems. This special issue show challenges and report state-of-the-art and in-progress research on all aspects of the answer to two questions: what can BAs do for parallel computer architectures? And, what can parallel computer architectures do for BAs?

For this special issue of the *International Journal of High Performance Systems Architecture*, we have selected seven top quality papers that were presented this year at the first Workshop on Parallel Architectures and Bioinspired Algorithms (WPABA) held in conjunction with the Parallel Architectures and Compilation Techniques (PACT 08) Conference in Toronto, Canada. My co-chairs at this event were Juan Lanchares and Francisco Fernández. All of these papers deal with the use of parallel architectures and BAs. I am grateful to the authors for their contributions to this special issue. Next, I will introduce these papers.

In the paper titled 'Particle swarm optimisation of memory usage in embedded systems' authors propose a dynamic particle swarm optimiser (H-NSPSO), for memory usage optimisation in embedded systems. It significantly reduces the computational complexity of others multi-objective particle swarm optimisation (MOPSO) algorithms. The method is evaluated using two real world examples in embedded applications and compared with existing covering methods. This paper is a clear answer to what BAs can do for parallel computer architectures. Another example is the paper titled 'Particle swarm optimisation for the design of two-connected networks with bounded rings'. In this paper the particle swarm optimisation (PSO) is used for designing minimum cost two-connected networks such that the shortest cycle to which each edge belongs to does not exceed a given length. Given that the topological network design problem is a highly constrained discrete combinatorial optimisation, authors modify the particle position representation and the particle velocity update rule by introducing an oscillating mechanism to better adapt a standard PSO for the problem. They provide results based on randomly generated graphs comparing their results with other heuristics such as tabu search and GAs showing the potential of the PSO approximation.

During the last five years graphic processing units (GPUs) have evolved rapidly and nowadays constitutes a powerful parallel architecture tool. In this way the paper 'Genetic programming on GPUs for image processing' shows how GPUs can tackle the problem of evolution of image filters using genetic programming. Authors demonstrate that the parallel processors available on modern GPUs can be used to reduce the time need for evaluation the solutions. They also shows that other more complicated processes can also be successfully evolved with GPUs and that it is possible to do 'reverse engineer' from filters used in common graphics manipulation programs.

'High performance computing for dynamic multi-objective optimisation' is a paper where a generic parallel procedure for dynamic problems using evolutionary algorithms (EAs) is presented. In dynamic multi-objective problems, the objective functions and the constraints can change overtime. Authors introduce a generic parallel procedure for multi-objective EAs, through a master-slave paradigm. They also give a model to understand the benefits of parallel processing in dynamic multi-objective problems.

Other interesting paper is 'Using cellular automata for parallel simulation of laser dynamics with dynamic load balancing', where an analysis of the feasibility of executing a parallel bioinspired model of laser dynamics is presented. It is based on cellular automata (CA) model that employs a

synchronous cellular automaton, using the single program, multiple data (SPMD) paradigm. They present a very interesting evaluation of the performance including artificial load to simulate other tasks or jobs submitted by other users.

The paper 'Resilience to churn of a peer-to-peer evolutionary algorithm' analyse the resilience of a peer-to-peer (P2P) EA subject to the following dynamics: computing nodes acting as peers leave the system independently from each other causing a collective effect known churn. Authors perform a scalability analysis in five different scenarios using the massively multimodal deceptive problem as a benchmark. In all cases, the P2P EA reaches the success criterion without a penalty on the runtime.

Finally, the problem of selecting an adequate set of variables from a given data set of a sampled function is the focus of the paper 'Minimising the delta test for variable selection in regression problems'. Authors show that the delta test is a powerful tool to determine if a subset of variables is correct what becomes crucial by the time of designing the model for regression problems. The algorithms were run in parallel architectures obtaining better performances in smaller amounts of time, presenting great robustness and scalability. This paper received the Best Paper Award of the workshop.