MASSIVELY PARALLEL AND DISTRIBUTED EVOLUTIONARY COMPUTATION

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Parallel and distributed computing systems have come a long way from specialized big-scale computer systems such as Grids and clusters. Nowadays, multi-core processing is present in our desktop systems and smartphones as well as other mod cons. Parallel and distributed computing systems have also moved from being permanent, physical and synchronized systems to being used in an ad hoc, temporal and virtual (cloud) asynchronous manner. Thus, the adaptation of evolutionary algorithms of any kind to these environments presents unique challenges from many points of views: from the purely theoretical that studies the influence of different types of communication among populations, to the practical that intends to predict the performance of the parallel system or apply it to a particular problem. Additionally, the challenges of nowadays optimization problems can be characterized following different complex and cross-dependent aspects: a large number of decision variables, a large number of conflicting objectives, expensive evaluation functions, simulation-dependent problem formulations, uncertain and scenario-based models, multi-disciplinary models, non-smooth and multi-modal black-box setting, etc. These characteristics give rise to difficult issues being beyond the ability of commonly used optimization algorithms. In this respect, there is evidence that decentralized evolutionary computing and general purpose metaheuristics will play a crucially important role in order to foster the next generation optimization techniques and to accelerate their widespread uptake.

This special session aims at fostering the cross-fertilization of knowledge between evolutionary algorithms, or metaheuristics in general, and parallel, distributed and concurrent computing, in order to address increasingly complex and large scale optimization problems. Working in two domains of research can be hard, but the cross-fertilization might be fruitful. Knowledge about parallel computing helps in creating parallel algorithms for clouds, multi-core or GPU architectures. However, this also implies the need for a careful definition of proper benchmarks, software tools, and metrics to measure the behavior of algorithms in a meaningful way. In concrete, a conceptual separation between physical parallelism and decentralized algorithms (whether implemented in parallel or not) is needed

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to better analyze the resulting algorithms.

This special session is expected to collect contributions, from the theory through the implementation, to the application of techniques born from the crossover with metaheuristics of the traditional research fields in parallel computing. Articles are solicited, that describe significant and methodologically well-founded contributions to problem solving, aimed at maximizing both efficiency and accuracy.

Topics

- Parallel/distributed/concurrent (PDC) evolutionary, memetic, dynamic algorithms and metaheuristics, for single- and multi- objective combinatorial and continuous problems
- Decentralized evolutionary optimization techniques and paradigms with clear parallel potential for big optimization problems, e.g., divide-and-conquer techniques, aggregation and grouping-based algorithms, novel decomposition-based techniques in decision and objective space, novel parallel models for large scale optimization
- Parallel/distributed/concurrent (PDC) computing models and/or their realizations in practice: cloud, P2P, browser-based, socket-based, mobile, etc
- Tools for helping in designing new parallel algorithms, PDC software frameworks/libraries
- PDC test benchmarks, performance evaluation and scalability issues
- Theory of PDC evolutionary algorithms and metaheuristics
- Big data and cloud computing
- MapReduce implementations of evolutionary computation or swarm intelligence approaches
- Real-world applications and computational investigations on the solving of big optimization problems