Metaheuristics on GPU

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Abstract. Over the last years, interest in metaheuristics has risen considerably in the field of optimization. Combinations of algorithms such as evolutionary algorithms and local search methods have provided very powerful search algorithms. However, problems in practice are becoming more and more complex and CPU time-intensive and their resolution requires to harness more and more computational resources. In parallel, the recent advances in hardware architecture allow to provide such required tremendous computational power through GPU infrastructures. This new emerging technology is indeed believed to be extremely useful to speed up many complex algorithms. However, the exploitation of such computational infrastructures in metaheuristics is not straightforward. Indeed, several scientific challenges mainly related to the hierarchical memory management or the execution context have to be faced. The main objective of our research work is to deal with such issues for the re-design of parallel metaheuristics models to allow solving of large scale optimization problems on GPU architectures. Our challenge is to come out with the GPU-based design of the whole hierarchy of parallel models. As a main result, we already proposed methodologies for building efficient parallel algorithms on GPUs such as parallel local searches or the island model for evolutionary algorithms. Apart from being generic, we proved the effectiveness of our proposed methodologies by making extensive experiments. In particular, we show that they enable to gain very significant factors in terms of acceleration when deploying them for well-known instances in comparison with mono-CPU architectures.

Key words: GPU computing for metaheuristics, local search algorithms on GPU, GPU-based evolutionary algorithms.