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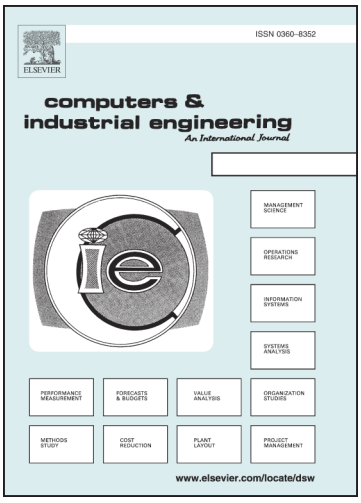

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Cooperative parallel grouping genetic algorithm for the one-dimensional bin packing problem

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Abstract

Evolutionary algorithms have been reported to be efficient metaheuristics for the optimization of several NP-Hard combinatorial optimization problems. In addition to their ability to solve difficult and complex problems in reasonable execution times, parallelized versions of evolutionary algorithms are reported to explore and exploit the problem search space more effectively than their sequential counterparts. The *Island* Model, where the population of a given run is divided into semi isolated subpopulations is a popular parallelization approach for evolutionary algorithms such as Grouping Genetic Algorithms (GGA). Although the nature of GGAs is very suitable for coarse-grained parallel processing, designing an Island-parallel model for them is not a straightforward task. Selecting the communication topology, deciding migration and assimilation strategies, adjusting the migration rate and frequency, and using efficient diversification techniques are some of the important issues that needs to be covered in a successful Island-parallel Model. In this study, we propose a novel, scalable Island-parallel GGA (IPGGA) for the well-known combinatorial optimization problem 1D Bin-Packing (1DBPP). We provide a thorough experimental evaluation of the parallel model and report significant improvements on the Hard28 problem instances by outperforming the state-of-the-art genetic algorithms. Additionally, we analyze and evaluate the parallelization parameters of IPGGA with an emphasis on problem search-space diversity and report several interesting results.

Keywords: 1D Bin-Packing, Grouping genetic algorithm, Parallel evolutionary algorithms, Search space diversity, Migration topology, Migration strategy, Assimilation strategy

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