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Editorial

Optimizing the allocation of manufacturing resources has been widely studied in the past few decades. Mathematical programming might have been the most popular solution approach. Such approaches in dealing with the problems with complex nonlinear characteristics usually do not perform well both in solution quality and computation time. Genetic algorithms (GA), justified in much literature, do outperform the mathematical programming methods in many applications.

The idea of genetic algorithm (GA) was designed to solve the optimization algorithm by an ''intelligent random-search''. The intelligence is carried out by randomly creating candidate solutions and keep high quality ones. The high quality solutions are taken as parents in generating the new candidates. This solution–generation procedure is for screening out the good attributes (or *gene*) of a good solution, and is therefore called *genetic algorithm*.

This special issue aims to promote the application of GA in the area of manufacturing management. Through the dissemination of GA application experiences, the application territory of GA may be expanded and researchers in manufacturing management may come to enhance GA or even develop more intelligent random-search tools in solving the optimization problems.

We received 18 papers submitted to the special issue. Many of them are good papers with interesting application examples. Due to space constraint, we can only include the following seven papers in this special issue, which cover a wide range of manufacturing applications. On behalf of the editorial team, we thank all the authors submitting papers and all the reviewers for making this special issue a quality one.

The first paper is concerned with the classical ''rc-mPSP'' problem (known to be NP-hard). This paper, ''Hybrid Genetic Algorithm with Adaptive Abilities for Resource-constrained Multiple Project Scheduling'', by Kim, Yun, Yoon, Gen, and Yamazaki, presents an improved version of the conventional genetic algorithm solutions. The novel approach is based on the design of genetic operators with fuzzy logic controllers. Their method is compared with other methods in the literature (as hGA, a-hGA) and show very promising results.

The second paper, ''Genetic Algorithms for Integrated Preventive Maintenance Planning and Production for a Single Machine'', by Sortrakul, Nachtmann, and Cassady, proposes a methodology to integrate the rather vague processes of production scheduling and preventive maintenance—processes that are usually considered independent in industrial settings. Using GA heuristics to solve these problems simultaneously is investigated. Experimental results confirm a clear improvement over a previously investigated method.

The third paper, ''Batching Orders in Warehouses by Minimizing Travel Distance with Genetic Algorithms'' by Hsu, Chen, and Chen, discusses a novel approach for order batching (another NP-hard problem) based on genetic algorithms. Even the method is rather computationally intensive (needing computer time in terms of hours); the results show that the method can be applicable in real situations.

The fourth paper, ''Advanced optimal tolerance design of mechanical assemblies with interrelated

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chains and process precision limits'', by Singh, Jain, and Jain, proposes the application of genetic algorithms to the field of tolerance design. Optimal solutions for advanced tolerance design problems are impossible (NP again) to be computed with brute-force algorithms and this non-traditional approach shows clear advantages, applied to suitable examples encompassing non-linear design functions.

The fifth paper, ''Immune Algorithms based approach for Redundant Reliability Problems with Multiple Component Choices'', by Chen and You, considers the application of a special branch of genetic algorithms (i.e. immune algorithms) to the system reliability optimization problem. The results are benchmarked for documented 33 test problems for this specific area, problems that have been solved with other meta-heuristics as simulated annealing, tabu-search, fuzzy optimization, classical genetic algorithms, etc. Results indicate that although the computational effort is somehow higher for this method than for the others, the quality of the solution is better.

The sixth paper, ''A solution to the unequal area facilities layout problem by genetic algorithm'', by Wang, Hu, and Ku, shows that the genetic algorithm approach for facility layout problems is feasible. Comparison with other results from literature shows very interesting conclusions, illustrating that a well-known empirical viewpoint (''the square is the best site'') can be proven in a rigorous way.

The seventh paper, ''Optimal Sequencing of Tasks in an Aluminum Smelter Cast-house'', by Jensson, Kristinsdottir, and Gunnarsson, examines a specific problem encountered in an enterprise in Iceland. The novelty here is to combine the classical approach of Integer Programming with genetic algorithms, applying these accordingly, depending on the size and complexity of the problem.

We may conclude from the above examples that genetic algorithms certainly deserve a prominent place in the set of meta-heuristics applicable to optimization problems in industry. However, we should also acknowledge that our understanding of the reasons why these algorithms prove successful for these particular cases is poor. The scientific community should as a next stage tackle the question of which meta-heuristic is applicable in which cases, in order to provide better education in academia and better tools in practice.

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