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IMPROVING EXPLORATION AND EXPLOITATION CAPABILITY OF HARMONY SEARCH ALGORITHM

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Harmony Search (HS) is a meta-heuristic algorithm which was first introduced in 2001 and it became a widely used optimization algorithm in various areas in engineering application as well as in water resources planning and management. However, as most meta-heuristic algorithms are, the HS shows a good performance in global search but not as good in local search. This study aims the improvement of both exploration and exploitation capability of the algorithm. The mission has been carried out by changing algorithm operators or parameters in the search process. Several types of Improved Harmony Search (IHS) have been successfully developed resulting better exploiting (local) search. Alternative way is to utilize the superior local search of other models or algorithms. The combined, so called hybrid algorithms can significantly supplement the weak local search aspect of the original HS. A newly developed hybrid algorithm, Smallest Small World Cellular Harmony Search (SSWCHS), is developed and proposed shorter characteristic path length and higher clustering coefficient, resulting good exploration and exploitation efficiency. Application to benchmark functions and design of pipe networks proves the superior performance of the newly developed hybrid algorithm.

KEYWORDS

Harmony Search Algorithm, Hybrid Algorithm, Smallest Small World Cellular Harmony Search, Exploration and Exploitation, Cellular Automata.

INTRODUCTION

A new hybrid optimization algorithm, Cellular Harmony Search (CHS) is developed by combining the original Harmony Search algorithm (Geem et al. [1], Kim et al. [2]) with the Cellular Automata theory, which is known to be efficient in local search. The CHS shows enhanced results compared to the original HS. Another new algorithm is developed by combining the CHS with the Smallest Small World theory. This Smallest Small World Cellular Harmony Search (SSWCHS) algorithm shows superb results both in benchmark functional problems (Im et al. [2]) and practical engineering problems like optimal design of pipe networks. The flowchart of the SSWCHS is shown in Fig. 1. The new algorithm is applied to the Hanoi network and the Valerma network. The comparison with the results from other

algorithms in the literature proved that the new algorithm either requires less number of iteration or finds better solutions with the same number of iterations.
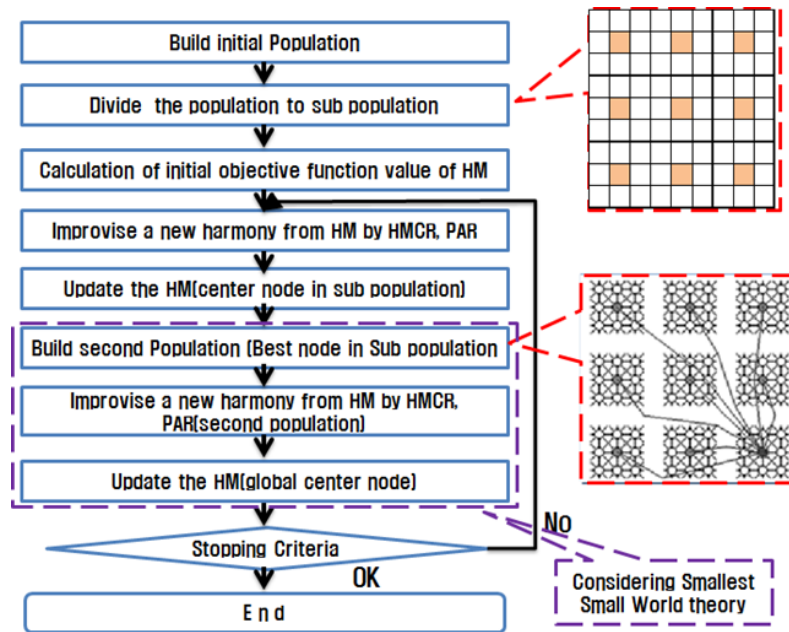

Figure 1. Flowchart of SSWCHS (after Im et al. [3])

CONCLUSION

The original Harmony Search works efficiently for most of combinatorial optimization problems. Still there have been many attempts to improve the local search by changing algorithm operators or parameters in the search process. A newly developed SSWCHS fulfills the objective of making a hybrid algorithm in that it provides good exploration and exploitation efficiency.

ACKNOWLEDGMENT

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