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A HYBRID SEARCH ALGORITHM WITH OPTIMAL COMPUTING BUDGET ALLOCATION FOR RESOURCE ALLOCATION PROBLEM

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ABSTRACT

In this paper, a simulation-based optimization approach, named NH_{OCBA}, for a typical resource allocation problem is presented. The hybrid algorithm based on neighborhood algorithm is applied to explore toward optimal direction in design space. For increasing efficiency, an optimal computing budget allocation (OCBA) is adopted to compute the optimal number of replications and to provide reliable evaluation of variance. In addition, we deal with the resource allocation problem which exist multiple global optima in design space. Therefore, a trim procedure which prevents to allocate extra numbers of replication to local optima has been proposed to enhance efficiency. Then, we use confidence interval at the end of algorithm procedure to find an optimal set instead of an optimal solution from design space. Finally, we compare the NH_{OCBA} with different algorithms by experimentation study which shows that NH_{OCBA} approach can perform better than the other algorithms under certain conditions.

1 INTRODUCTION

Simulation optimization refer to methods that solving complex and large space system which cannot be a closed form mathematical model. In this study, we propose an algorithm to support the determination of the number of resource in the manufacturing line. The hybrid algorithm based on neighborhood algorithm for generating various design alternatives to explore design space, and then allocating simulation replications and identifying e best solution by OCBA procedure. In the meantime, we use the technique of trim to avoid allocating extra number of replications to two or more design alternative which are the best performance in each iteration. Finally, we check the trim set which is an optimal solution by confidence interval at the end of algorithm procedure.

2 PROPOSED NH_{OCBA} ALGORITHM

The conceptual framework of hybrid algorithm is shown in Figure 1. This simulation optimization framework is composed of a neighborhood algorithm, which generates design alternatives to exploit the solution space, and discrete event simulation with OCBA to estimate performance. To overcome allocate extra number of replications and distinguish local optima in each iteration, we attempt to address trim controlling and check trim set which is an optimal solution by confidence interval at the end of algorithm procedure.

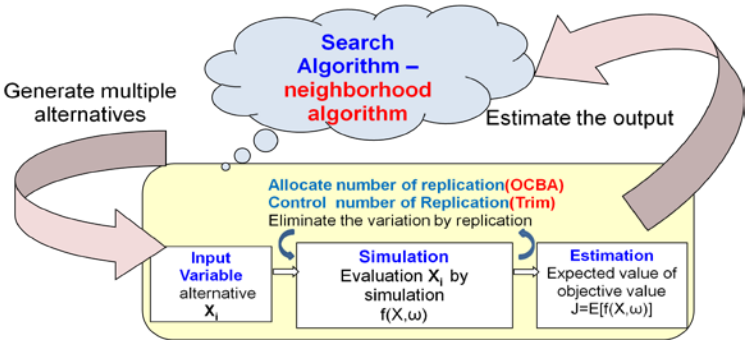

Figure 2: Conceptual framework of hybrid algorithm

3 NUMBERICAL EXPERIMENTS AND COMPARISONS

Based on this study, we consider more robust way for searching quality and more efficient way to use number of replications in NH_{OCBA} algorithm. The concept solves integration of search algorithm and OCBA and it create the new problem in multimodal environment. It not only supports high searching quality, but also reduces the number of replications.

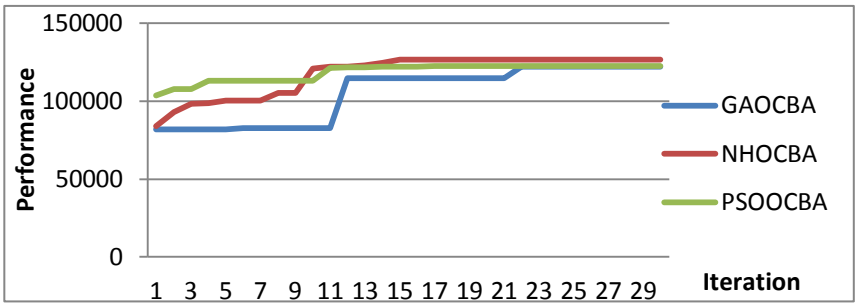

Figure 6: Convergence process at 30 iteration of each algorithm

4 CONCLUSION

This paper proposed an effective approach offering a simulation optimization framework that combined searching algorithm with OCBA and trim concept for optimizing resource allocation problem in a manufacturing line. After validating and evaluating the performance, among these six methodologies, the NH_{OCBA} approach has been proven to have the best problem-solving effect and to reduce the times of replication. The hybrid algorithm not only provides robust searching quality and efficiency of computing budget, but also gets multiple decision of optimal set.

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