A SIMULATION OPTIMIZATION ALGORITHM WITH HEURISTIC TRANSFORMATION AND ITS APPLICATION TO VEHICLE ROUTING PROBLEMS

Xiangpei Hu[1], Yongxian Li[1,2], Jianwen Guo[1]
Lijun Sun[1] and Amy Z. Zeng[3]

[1]Institute of Systems Engineering
Dalian University of Technology
Dalian, Liaoning Province 116023, P. R. China
drhxp@dlut.edu.cn

[2]School of Management
Liaoning Normal University
Dalian, Liaoning 116029, P. R. China
lyxwlb@163.com

[3]Department of Management
Worcester Polytechnic Institute
Worcester, MA 01609, USA
azeng@wpi.edu

Abstract. *With a focus on improving the efficiency of simulation optimization (SO), this paper presents a heuristic transformation based simulation optimization algorithm. The principle of this simulation optimization with Heuristic Transformation (SOHT) and the methods - matrix analysis and transformation that are used to realize the algorithm are first described. Then, the algorithm is applied to solving the Vehicle Routing Problems with rigid time windows. Finally, a system that can execute the computational experiments is presented. The results show the efficiency and effectiveness of SOHT.*
Keywords: Simulation, Optimization, Heuristic algorithm, Vehicle routing problem (VRP)

1. **Introduction.** Today's systems, which need to be designed and controlled in an optimal way, are so complex that traditional analytical approaches alone result in only non-sufficient solutions [1]. As Pegden [2] suggested, the simulation technique is an effective and powerful tool to deal with the optimal design and control of complex systems. The biggest advantage of simulation is that it can provide detailed information about a real system and model a real-world problem that is impossible to be formulated by mathematical equations due to the complexity of the problem.

However, as the simulation model is a direct description of a problem, this method provides only a feasible, but not necessarily an optimal, solution under certain conditions. Thus, simulation should be integrated with optimization in order to continuously improve the outputs under various environments and finally to optimize the system's performance. The method of combining simulation with optimization is called simulation optimization, which is a process of finding the best values of input variables without evaluating all possible values. The objective of such a method is to minimize the consumption of resources while maximizing the information obtained in a simulation experiment [3].