Application of Bee Colony Optimization Algorithm in Warehouse Facility Location of Rail Transit Network

Kun Zhang[1], Hui Liu[1], and Kunlei Lian[2]

[1]China Railway Siyuan Survey and Design Group Co., Ltd. Wuhan, China. 430063

[2]State Key Laboratory of Digital Manufacturing Equipment & Technology, Huazhong University of Science and Technology, Wuhan, China 430074

Abstract

This paper proposes a mathematical model for the warehouse facility location problem in a rail transit network. A bee colony optimization algorithm is developed to identify the optimal number of warehouses as well as their locations. Problem-specific encoding scheme and crossover operator are designed to facilitate adaption of the algorithm. In addition, local search algorithm is developed to improve the algorithm's capability in searching for the global optimal solutions.

Key words: Rail transit, warehouse facility location, bee colony optimization

1 Introduction

In rail transit network systems, warehouse facilities play a key role in delivering the required equipment and materials in a accurate and timely manner, based on the needs of each lane. Warehouse facility locations therefore greatly affect whether a rail transit network system can operate efficiently at minimal costs. Moreover, the decision has a long-lasting effect on operation costs in future years as these facilities are hard to change once they are determined. An optimal warehouse facility location solution is desired in order to satisfy the requirements of each lane and minimise the total operation costs. It is common in current practices to set up a dedicated warehouse for each rail lane, which not only consumes more lands and investment, but also leads to duplicated and wasted stock of equipment and materials. With the advance of rail transit systems in China, it is anticipated that they will be built in more cities, with major ones witnessing as many as seven or eight rail lanes. It remains an urgent task to identify the best warehouse facility locations for these systems.

2 Improved colonial competitive algorithm for the minimal hitting set problem

3 Application in equipment selection

Table 1: Manufacturing units of parts

part	manufacturing unit	part	manufacturing unit	part	manufacturing unit
1	A B F H	9	D H I J	17	A J K
2	C G H	10	E H J L	18	E L
3	D J L	11	H K	19	D H I
4	B I	12	D F L	20	B E J K
5	A B E G K	13	B G J	21	J L
6	C D H L	14	C J K L	22	G
7	D G H	15	E H K	23	E G K
8	A C J L	16	A C F H J		

4 Experiments

5 Conclusions

References