An Efficient Genetic Algorithm for Fixed Channel Assignment Problem with Limited Bandwidth Constraint

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Abstract

This paper proposes a new efficient genetic algorithm for a fixed channel assignment problem with limited bandwidth constraint. Results are given which show that our GA produces far better solutions than the previously proposed GA the problem.

1 INTRODUCTION

The channel assignment problem (CAP), or frequency assignment problem (FAP) is a very important problem today, but is a difficult, NP-hard problem. To achieve the optimal solution of fixed channel assignment problems, most proposed algorithms try to minimize the amount of necessary channels under satisfying a set of given constraint (e.g., Matsui and Tokoro, 2001).

However, the total number of available channels, or bandwidth of frequencies, are given and fixed in many situations. Minimizing the bandwidth becomes meaningless for such applications. To address the problem, Horng et al. proposed a new cost model, where the objective is to minimize the total cost, the sum of the cost of blocked calls and the cost of interference. They also proposed a GA to solve the problem (Horng et al., 2001). But the performance of the GA is not good enough.

We propose a new genetic algorithm for the problem. The proposed GA is tested using the same problems by Horng et al., and the performance is far better than their GA.

2 THE PROPOSED ALGORITHM

The main idea of the proposed GA is to use a chromosome representation that encodes sequences of codes of a virtual machine that performs assignment. The GA searches a good sequence of codes that minimize the total cost.

The proposed steady-state GA uses a local search and a modified version of the adaptive mutation scheme proposed by Matsui and Tokoro (2001).

Table 1: Solutions of the problems.

	GA by Horng et al.		Proposed GA	
P	Best	Average	Best	Average
P1	203.4	302.6	3.7e-4	3.7e-4
P2	271.4	342.5	4.1	4.1
P3	1957.4	2864.1	5.8	7.4
P4	906.3	1002.4	243.8	249.7
P5	4302.3	4585.4	564.1	710.5
P6	4835.4	5076.2	594.7	746.0
P7	20854.3	21968.4	3322.0	3832.8
P8	53151.7	60715.4	28976.1	30815.6

3 EXPERIMENTS AND RESULTS

We tested the performance of the GA by running 100 times for 8 problems proposed by Hong et al.(2001). For all the experiments, the population size was 100, the maximal number of generation was 1000, the crossover ratio was 0.8, and the number of new offsprings was equal to the population size.

The comparison with the results by Horng et al.(2001) are shown in Table 1. The column P denotes the problem name, the column 'Best' shows the minimum cost found in the 100 runs, and the column 'Average' shows the average cost over the 100 runs. Table 1 shows that our GA performs very well, it outperforms the previous GA (Horng et al., 2001) for all cases, the cost obtained by our GA is very small compared to the ones by theirs.

References

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