BIO-INSPIRED EVOLUTIONARY METHOD FOR CABLE TRENCH PROBLEM

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ABSTRACT. *A bio-inspired evolutionary method with DNA is presented for solving a cable trench problem in this paper. The cable trench problem is a combination of the shortest path problem and the minimum spanning tree problem, which makes it difficult to be solved by a conventional computing method. DNA computing is applied to overcome the limitation of a silicon-based computer. The numerical values are represented by the fixed-length DNA strands, and the weights are varied by the melting temperatures. Biochemical techniques with DNA thermodynamic properties are used for effective local search of the optimal solution.*
Keywords: Bio-inspired computing, DNA computing, Evolutionary computation, Combinatorial optimization, Cable trench problem

1. **Introduction.** Ever since scientists discovered that conventional silicon-based computers have an upper limit in speed, they have been searching for alternative media to solve computational problems. That search has led to other research areas, such as bio-inspired computing. Scientists have found the new material which has the potential to be the next generation of microprocessors, the deoxyribonucleic acid (DNA), and the technique is known as DNA computing. DNA computing began in earnest by Adleman [1] in solving a Hamiltonian path problem in 1994 [5]. Since then, the implementation of computation using DNA has attracted a great of amount of attention in the fields of computer science and biochemistry.

In the last decade, many evolutionary algorithms have been proposed in terms of DNA computing. The massive parallelism of the DNA computing provides an opportunity to solve a number of difficult problems, especially the NP (nondeterministic polynomial time) problems. NP problems are a class of mathematical problems which have most likely exponential complexity, for which no efficient solution has been found yet [4].

The cable trench problem (CTP) is classified as network routing problem. It is a combination of the shortest path problem and the minimum spanning tree problem. These two problems have been universally discussed in operations research and management engineering, which is difficult to be solved by conventional computer. CTP is an NP-complete problem, in which there is a tradeoff between the fixed cost associated with constructing the network and a variable cost associated with operating it [16].