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MULTI-COLONY ANT ALGORITHM USING PHEROMONE CROSSOVER BASED ON MULTI-OPTIMUM FOR TSP

Enxiu Chen[1] and Xiyu Liu[2]

[1]School of Management and Economics
Shandong Normal University, Jinan, Shandong 250014, P.R. China
Email: system863@163.com

[2]School of Management & Economics
Shandong Normal University, Jinan, Shandong 250014, P. R. China
Email: xyliu@sdnu.edu.cn

Abstract. As a new class of global searching algorithms, ant colony optimization algorithm could solve TSP (traveling salesman problem). These algorithms include ant colony system (ACS), MAX-MIN ant system (MMAS), et al. This paper presents a new method named multi-colony ant algorithm based on pheromone crossover. This algorithm avoids some defects of ACS and MMAS. These defects make algorithm not iterate when it has arrived at the stagnating state of the iteration or local optimum solution. But for multi-colony ant algorithm, it reinitializes the worst one of ant colonies by using pheromone arithmetic crossover based on multi-optimum and reiterate when meeting those states. At the same time, the main parameters α, β and ρ of algorithm are adjusted self-adaptively. In this paper, a parallel asynchronous algorithm process is also presented. At the end of this paper, the experimental result is presented to show the effectiveness of this method.
Keywords. Ant colony system, Multi-colony ant algorithm, Parallel algorithm, Pheromone Crossover, Reinitialization.
AMS (MOS) subject classification: 68T35.

1 Introduction

The first ant colony optimization algorithm called ant system was inspired through studying of the behavior of ants in 1991 by Macro Dorigo and coworkers [3]. An ant colony is highly organized, in which one interacting with others through pheromone in perfect harmony. Optimization problems can be solved through simulating ant's behaviors. Since the first ant system algorithm was proposed, there is a lot of development in ant colony optimization. In ant colony system algorithm, local pheromone is used for ants to search optimum result. However, high magnitude of computing is its deficiency and sometimes it is inefficient. Thomas Stützle et al introduced MMAS [9] in 2000. It is one of the best algorithms of ant colony optimization. It limits total pheromone in every trip or sub-union to avoid local convergence. However, the limitation of pheromone slows down convergence rate in MMAS.