

Pheromone models in ant colony optimization (ACO)

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Abstract

Ant Colony Optimization is a constructive meta-heuristic that uses an analogue of ant trail pheromones to learn about good features of solutions. In this paper, using the difference equations as a tool of research, we propose the mathematical model of the distribution of pheromone at the classic double bridge experiment, explain the mathematical model of the pheromone function in the arcs of a connected graph and specify the mathematical models of pheromone update in Ant Colony System (ACS) and Max-Min Ant System (MMAS) algorithms.

Keywords and phrases : Ant colony optimization, pheromone, difference equations, stochastic model, ant colony system (ACS), max-min ant system (MMAS).

1. Introduction

A category of problems that appear in nature are the Hard Combinatorial Optimization Problems and their solution, using classic deterministic methods, is difficult, if not impossible. These difficulties were exceeded by the evolution of the stochastic heuristic algorithms and especially by those algorithms which are inspired by natural, biological or social phenomena [1]. The basic property of these algorithms is that they are

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