

Invited Session

The Ant Colony Optimization Metaheuristic

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Abstract

Ant colonies, and more generally social insect societies, are distributed systems that, in spite of the simplicity of their individuals, present a highly structured social organization. As a result of this organization, ant colonies can accomplish complex tasks that in some cases far exceed the individual capacities of a single ant.

The study of ant colonies behavior and of their self-organizing capacities is interesting for computer scientists because it provides models of distributed organization which can be used to solve difficult optimization and distributed control problems. In this talk, I will focus on a particular ant colony activity, foraging for food, and I will explain how it has been possible to take inspiration from this ants' behavior to design a new metaheuristic called "Ant Colony Optimization". I will show recordings of experiments with the real ants and then move to the definition of a few algorithms that were inspired by these experiments. In particular, I will discuss ant algorithms for the solution of difficult problems such as routing in packet-switched networks and the approximate solution of NP-hard combinatorial optimisation problems. I will conclude the talk defining what ant colony optimization is, and mentioning a few theoretical results and the main practical successes.