

KNOWLEDGE-BASED ANT COLONY OPTIMIZATION FOR THE FLEXIBLE JOB SHOP SCHEDULING PROBLEMS

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Abstract. Integrating knowledge model and heuristic searching model can be seen as a useful tool in the search of an optimal solution. It proposed a Knowledge-based Ant Colony Optimization (KACO) for solving the Flexible Job Shop Scheduling Problem (FJSSP) in this work. Knowledge model and Ant Colony Optimization (ACO) model are two modules of KACO. The ACO model takes charge of searching through the vast solution space and identifying an optimal solution. The knowledge model learns some available knowledge from the evolution, and then applies the existing knowledge to guide the current heuristic searching. The optimization performance of the proposed approach has been improved largely by efficaciously integrating scheduling knowledge with ACO. The experimental results suggest that the proposed algorithm is a feasible and effective approach for the Flexible Job Shop Scheduling Problem.

Keywords. Combinatorial optimization, Multi-objective optimization, Flexible job shop scheduling, Ant colony optimization, Scheduling knowledge.

AMS (MOS) subject classification: 90C27

1 Introduction

Scheduling problems occur in all the economic domains, from computer engineering to manufacturing techniques. These problems are generally defined as decision-making problems with the aim of optimizing one or more scheduling criteria. The Job Shop Scheduling Problem (JSSP) is a branch of production scheduling, which is among the hardest combinatorial optimization problems. The diversity of scheduling problems, large-scale dimensions and their dynamic nature make scheduling problems computationally very complex and difficult to solve. Many different approaches, such as simulated annealing [27, 42], tabu search [28, 33], genetic algorithm [17, 30, 32, 41, 44], ant colony optimization [20, 39], neural networks [15, 40], evolutionary algorithm [18, 34] and other heuristic approaches [1, 8, 21, 24, 35] have been successfully applied to JSSP.

Although an optimal solution algorithm for the classical JSSP has not been developed, there is a trend in the research domain to solve the Flexible Job Shop Scheduling Problem (FJSSP). FJSSP is an extension of the