

A SWARM OPTIMIZATION METHOD FOR THE FLOW SHOP SCHEDULING PROBLEM

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Abstract: *This paper considers the flow shop scheduling problem with the objective of minimizing the makespan, and can be described as: a set of n jobs that has to be processed on m machines, all the jobs having the same processing order that cannot be interrupted. The objective consists of minimizing the maximum completion time of all the operations or makespan. A particle swarm optimization algorithm is proposed to solve this problem which is known to be NP-hard type. The proposed algorithm is compared with solution performance obtained by a branch & bound technique. As a result, computational results show that the proposed method is more effective and better.*

Keywords: *flow shop, particle swarm optimization, schedule.*

1. Introduction

The flow shop scheduling problem takes a significant place in the schedule theory because of its implication and practical importance in industry related problems. Being involved in most of the product production stages, many researchers have tried to study it from different perspectives along the years, elaborating different methods, techniques and algorithms that can solve this problem thus improving productivity and optimization of production resources.

Over the time, various methods were proposed for solving this problem, starting from exact methods like linear programming [1], dynamic programming [2,3] or branch and bound techniques [4,5,6,7]. In solving small size problems these methods are the most efficient, but when dealing with big size problems the number and complexity of the equations make solving the problem with these techniques impossible. In the late years more and more importance is assigned to heuristic methods like genetic algorithms [8,9,10], tabu search [11,12] or artificial intelligence techniques [13,14,15]. Taking its place among the vast number of artificial techniques, the

method used in this paper consists of a modified swarm optimization algorithm.

2. Problem description

The flow shop scheduling problem can be explained as follows: a set of n jobs has to be processed in the same sequence on m machines. The processing time of job i on machine j is to be $t(i,j)$.

The problem consists of minimizing the makespan C_{\max} or the maximum completion time of all jobs. When solving the problem several restrictions have to be taken in consideration: a machine can process only one job at a time, the operations are not preemptable, the setup times are included in the processing time.

3. The PSO method for flow shop

Swarm Intelligence is a computational paradigm based on the study of collective behavior in decentralized, self-organized systems. The self-organizing mechanism is based on several components: amplification by positive reaction, structure stability by negative reaction, multiple interactions, the presence of a random component.