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ABSTRACT

The flow shop scheduling problem is one of the most important types of scheduling with a large number of real-world applications. In this paper, we propose a new algorithm that integrates the Whale Optimization Algorithm (WOA) with a local search strategy for tackling the permutation flow shop scheduling problem. The Largest Rank Value (LRV) requires the algorithm to deal with the discrete search space of the problem. The diversity of candidate schedules is improved using a swap mutation operation as well. In addition to the insert-reversed block operation is adopted to escape from the local optima. The proposed hybrid whale algorithm (HWA) is incorporated with Nawaz – Enscore - Ham (NEH) to improve the performance of the algorithm. It is observed that HWA gives competitive results compared to the existing algorithms.

Keywords

Flow shop scheduling, Makespan, Whale Optimization Algorithm, Hybrid Algorithm, Local search

1. Introduction

Recently, much attention is paid towards the flow shop scheduling problem (FSSP) because of its vital role in the procurement, production, computing designs, distribution, transportation, information processing and communications. FSSP is considered as an NP-hard problem since finding a solution in a polynomial time is difficult. Because of the importance of this problem, several attempts have been made in the literature to develop algorithms that achieve two objectives: minimizing the makespan of the best schedule as well as reducing the time complexity. FSSP was first introduced and formulated by Johnson 1954 [1]. Johnson obtained the optimal scheduling for the two-machine problem as well as the optimal scheduling for the three-machine problem but in a restricted case. Later, Nawaz et al. [2] introduced a heuristic algorithm for tackling m-machine and n-job FSSP called NEH (Nawaz – Enscore - Ham). NEH was compared with 15 algorithms and the results show that NEH works well for large FSSP. Although the time complexity of NEH was not excessive, it was much larger than the existing algorithms.