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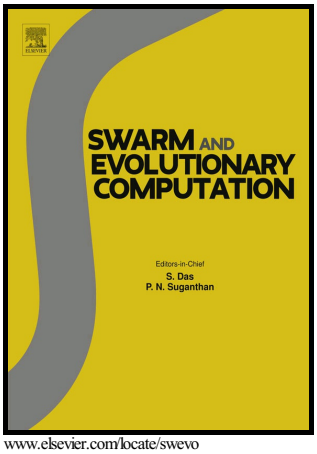

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An improved migrating birds optimization for an integrated lot-streaming flow shop scheduling problem

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Abstract: Lot-streaming is an effective technology to enhance the production efficiency by splitting a job or a lot into several sublots. It is commonly assumed that lot-splitting (i.e. job-splitting) is specified in advance and fixed during the optimization procedure in recent studies on lot-streaming flow shop scheduling problems. In many real-world production processes, however, it is not easy to determine the optimal lot-splitting beforehand. Therefore, in this paper we consider an integrated lot-streaming flow shop scheduling problem in which lot-splitting and job scheduling are needed to be optimized simultaneously. We provide a mathematical model for the problem and present an improved migrating birds optimization (IMMBO) to minimize the maximum completion time or makespan. In the IMMBO algorithm, a harmony search based scheme is designed to construct neighborhood of solutions, which makes good use of optimization information from the population and can tune the search scope adaptively. Moreover, a leaping mechanism is introduced to avoid being trapped in the local optimum. Extensive numerical simulations are conducted and comparisons with other state-of-the-art algorithms verify the effectiveness of the proposed IMMBO algorithm.

Keywords: Migrating birds optimization; Meta-heuristics; Lot-streaming; Flow shop; Harmony search

1. Introduction

The flow shop scheduling problem is one of the most popular combinatorial optimization problems, which has strong engineering backgrounds and has been extensively applied to formulate various practical issues [1]. For the classical flow shop scheduling problem, *n* jobs are processed on *m* machines with the same sequence and a job cannot be delivered to the downstream before the whole processing on it is finished. However, in many real cases such as in the manufacture of textile, plastic, chemical, semiconductor and so on, a job consists of numerous identical items and there is no need to transfer this job to the next machine until all items it contains are completed [2]. Thus, lot-streaming technique is introduced. The lot-streaming flow shop scheduling problem (LSFSP) is an extension to the conventional flow shop scheduling problem, in which a job can be split into a number of smaller sublots and a single sublot can be moved to the next machine as soon as the operation on it is completed. By job-splitting (also called lot-splitting) and operation overlapping between successive machines, the idle time can be reduced [3]. In recent years, LSFSPs have gained widespread attention and extensive studies have shown that lot-streaming can significantly improve the scheduling

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