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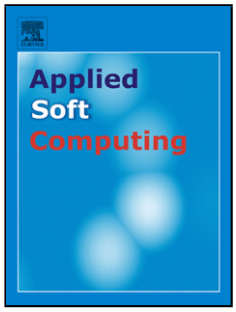

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Improved discrete cuckoo search for the resource-constrained project scheduling problem ☆

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Highlights

- Improving Cuckoo search (originally for continuous problems) to solve combination optimization problems.
- Proposing event combination technique (new)
- Developed a new strategy for Levy Flights: a combination of Event movement and Event combination

Abstract

An Improved Discrete Cuckoo Search (IDCS) is proposed in this paper to solve resource-constrained project scheduling problems (RCPSPs). The original Cuckoo Search (CS) was inspired by the breeding behaviour of some cuckoo species and was designed specifically for application in continuous optimisation problems, in which the algorithm had been demonstrated to be effective. The proposed IDCS aims to improve the original CS for solving discrete scheduling problems by reinterpreting its key elements: solution representation scheme, Lévy flight and solution improvement operators. An event list solution representation scheme has been used to present projects and a novel event movement and an event recombination operator has been developed to ensure better quality of received results and improve the efficiency of the algorithm. Numerical results have demonstrated that the proposed IDCS can achieve a competitive level of performance compared to other state-of-the-art metaheuristics in solving a set of benchmark instances from a well-known PSPLIB library, especially in solving complex benchmark instances.

Keywords: Scheduling; Resource-constrained project scheduling problem; Cuckoo search; Metaheuristics; Combinatorial optimisation

1 Introduction

Scheduling has been an active research topic in optimisation for many years. In literature, a variety of scheduling problems have been proposed (Tritschler *et al.*, 2017; Hartmann and Briskorn, 2010; Zhou and Zhong, 2007; and Hsu *et al.*,2004). Despite the variety, the majority of them can be classified as variations of Resource-Constrained Project Scheduling Problems (RCPSPs). The objective of an original RCPSP is to find a schedule for the minimal duration of a given project which consists of a set of activities with known deterministic durations and a set of resources with limited capacities. Blazewicz *et al.* (1983) described RCPSPs as a generalisation of a classical job-shop scheduling problem (Chen and Quan, 2008) and showed that they belongs to a class of NP-hard combinatorial optimisation problems.

In the last decades, RCPSPs have received a lot of attention because of the relative generality and numerous practical applications (Kolisch and Padman, 2001; and Herroelen *et al.*, 1998). As the result of this,