Integrating Employee Timetabling with Scheduling of Machines and Transporters in a Job Shop Environment: A Mathematical Formulation and an Anarchic Society Optimization Algorithm

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Integrating Employee Timetabling with Scheduling of Machines and Transporters in a Job Shop Environment: A Mathematical Formulation and an Anarchic Society Optimization Algorithm

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Abstract

This paper addresses a ternary-integration scheduling problem that incorporates employee timetabling into the scheduling of machines and transporters in a job-shop environment with a finite number of heterogeneous transporters where the objective is to minimize the completion time of all jobs. The problem is first formulated as a mixed-integer linear programming model. Then, an *Anarchic Society Optimization* (ASO) algorithm is developed to solve large-sized instances of the problem. The formulation is used to solve small-sized instances and to evaluate the quality of the solutions obtained for instances with larger sizes. A comprehensive numerical study is carried out to assess the performance of the proposed ASO algorithm. The algorithm is compared with three alternative metaheuristic algorithms. It is also compared with several algorithms developed in the literature for the integrated scheduling of machines and transporters. Moreover, the algorithms are tested on a set of adapted benchmark instances for an integrated problem of machine scheduling and employee timetabling. The numerical analysis suggests that the ASO algorithm is both effective and efficient in solving large-sized instances of the proposed integrated job-shop scheduling problem.

Keywords: Integrated job-shop scheduling; Transportation scheduling; Employee timetabling; Mixed-integer linear programming; Swarm intelligence and evolutionary algorithms; Particle Swarm Optimization (PSO)

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