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Discount Strategies Investigation in Integrated Project Scheduling and Material Procurement

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Abstract

On-time materials readiness on the sites plays a remarkable role in successful execution of projects. Hence, this paper has addressed concurrent formulation of project scheduling and material procurement by a mixed-integer programming model, aiming to minimize penalty/reward to deliver the project and material holding, ordering, and purchasing costs, respectively. Both all-units and incremental discount approaches are applied here to consider more real purchasing states. A genetic algorithm is used to solve the problems with large sizes, in particular, whose underlying factors are calibrated by the Taguchi method. Finally, the applicability and efficiency of the mathematical model is tested by a set of size-categorized instances.

Keywords: Project scheduling, material purchasing, Taguchi method, genetic algorithm.

1. Introduction

Resource-constrained project scheduling problem (RCPSP) has been receiving much attention within the last decades, since successful projects implementation can guarantee the organizations' survival. In other words, projects have come to exist in order to provide the adaptability tool for indispensable changes (Liu et al. [15]). On the other hand, it is crucial to have all required resources available on time in sites. Hence, a variety of research efforts have been devoted to resources planning in project management. However, there is unfortunately lack of noticeable quantity of integrated approaches to address the RCPSP and material ordering at the same time, despite the fact that simultaneous consideration of these two issues can improve total costs of a project.

According to the literature, Aquilano and Smith [1] presented the concept for the first time by developing a hybrid model including the critical path method and material requirement planning. Afterwards, Smith-Daniels and Aquilano [22] added an enhancement to the problem by a heuristic scheduling for large projects, considering the least slack rule. Smith-Daniels and Smith-Daniels [23] considered fixed duration for the activities and stated that the latest starting time schedule can end in an optimal solution. It was indicated that the problem could be solved optimally while it is decomposed into a