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Cyclic scheduling of perishable products in parallel machine with release dates, due dates and deadlines

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Abstract

This paper deals with a realistic cyclic scheduling problem in the food industry environment in which parallel machines are considered to process perishable jobs with given release dates, due dates and deadlines. Jobs are subject to post-production shelf life limitation and must be delivered to retailers during the corresponding time window bounded by due dates and deadlines. Both early and tardy jobs are penalized by partial weighted earliness/tardiness functions and the overall problem is to provide a cyclic schedule of minimum cost. A mixed integer programming model is proposed and a heuristic solution beside an iterated greedy algorithm is developed to generate good and feasible solutions for the problem. The proposed MIP, heuristic and iterated greedy produce a series of solutions covering a wide range of cases from slow optimal solutions to quick and approximated schedules.

Keywords: Parallel machine scheduling, Perishable products, Partial weighted earliness/tardiness, Due date, Deadline, Release date, Iterated greedy algorithm

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1 Introduction

The studied problem in this research is motivated by a real scheduling problem in the food industries. In food process control, safety of products has been one of the main objectives beside temporal and financial issues (Linko, 1998) and in the case of fresh products or highly perishable foods, final products are subject to deterioration through time. Hence, in most real cases, a limited post-production shelf life is considered, such that final products can be placed on supermarket shelves with a reasonable remaining shelf life. Moreover, some food products such as fresh foods or dairy products as subgroups of Fast Moving Consumer Goods (FMCG), have a quick turnover and need to be produced and distributed over a short period of hours, days or weeks. Therefore, the whole operations, due to limited post-production shelf life, should be carried out as

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