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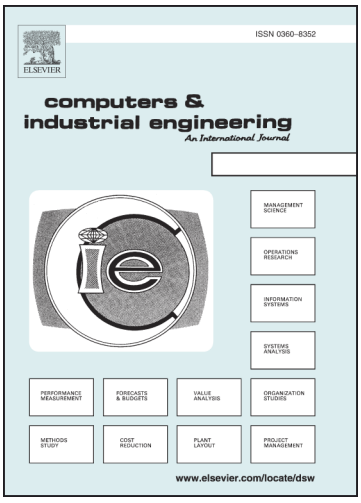

Scheduling trucks on factory premises

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Scheduling trucks on factory premises

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Abstract

Trucks carrying just-in-time parts for assembly plants need to be processed on the factory premises in a speedy manner to guarantee smooth operations, improve supply chain performance, and avoid demurrages. Traditionally, plant managers and logistics providers have long been dissatisfied with extensive waiting times and severe on-site congestion. In this context, we tackle the problem of scheduling a set of trucks arriving at an assembly plant to deliver parts to specific dock doors on the factory premises. Trucks must visit a given set of doors, and they have individual arrival and due dates. They should be scheduled such that the total weighted tardiness is minimal. We propose a mixed-integer programming model and develop bounding procedures and heuristics, which are shown to perform well in a computational study, yielding small optimality gaps in under a minute of runtime. Our tests also reveal that door assignment and time window management have a substantial impact on on-premise congestion.

Keywords: Just-in-time logistics; Factory premises; Open shop scheduling; Weighted tardiness; GRASP

1 Introduction

Due to the high volume and broad range of parts required for final assembly of cars on the one hand, and scarce inventory space as well as high holding cost on the other, employing just-in-time strategies for part feeding to automotive assembly plants is all but a necessity. This puts considerable pressure on the logistics processes to provide all required parts frequently in small lots to final assembly. For example, in the Czech Republic, the three Škoda plants alone require the transport of approximately 52,000 train cars and 468,000 truck loads per year (Hogg, 2015). Similarly, Battini et al. (2013) report that at the BMW plant in Dingolfing, Germany, each day about 400 trucks carrying more than 13,000 individual shipments from more than 600 suppliers have to be processed. Apart from making sure that the parts arrive on time at the plant (e.g., Boysen et al., 2016) and that they are distributed quickly in-plant once unloaded (e.g., Emde and Gendreau, 2017), the unloading of the individual trucks that have arrived at the original equipment manufacturer's (OEM) plant also needs to be scheduled. Boysen et al. (2015), for example, report on a major German automobile producer who has to handle on-site traffic of up to 500 trucks per day, docking at 70 unloading doors.

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