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UNRELATED PARALLEL MACHINE SCHEDULING WITH SEQUENCE- AND MACHINE-DEPENDENT SETUP TIMES AND DUE DATE CONSTRAINTS

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Abstract. *This study deals with the unrelated parallel machine scheduling problem with sequence- and machine-dependent setup times under due date constraints, a core topic for numerous industrial applications. In view of the computational complexity, an artificial bee colony (ABC) algorithm is presented to minimize the total tardiness. The performance of the proposed ABC algorithm is evaluated by comparing its solutions with those of state-of-the-art algorithms on the same benchmark problem set. Computational results show that the proposed ABC algorithm significantly outperforms existing algorithms for most problem combinations. This study offers a useful contribution to the growing body of both theoretical and practical ABC algorithms useful in scheduling problems.*
Keywords: Unrelated parallel machines, Total tardiness, Sequence-dependent setup times, Machine-dependent setup times

1. **Introduction.** The problem addressed in this study is the scheduling of N available jobs on M unrelated parallel machines with sequence- and machine-dependent setup times to minimize the total tardiness under due date constraints. Placing unrelated machines in parallel to enhance routing flexibility is common in many production systems in the textile, chemical, electronics manufacturing, plastics forming and service industries [1]. In an unrelated parallel machines environment, the machines are non-identical to one another and cannot be fully correlated by simple rate adjustments. Since the speeds of different machines do not have constant relationships, the processing time of jobs depends not only upon the job but also the characteristics of machine to which it is assigned. In a sense, each unrelated machine has its own matrix of sequence-dependent setup times.

A sequence- and machine-dependent setup time is usually incurred when switching between different types of jobs [2,3]. This type of setup can be found in many manufacturing processes (e.g., drilling operations for printed circuit board fabrication and dicing operations for semiconductor wafer manufacturing) [4]. With increasing on-time delivery requirements from customers, tardiness-related measures have become one of the most active research criteria for different scheduling problems over the past two decades [5]. Given the importance of this issue for industry, total tardiness is adopted as performance criterion in this study. In addition, we consider the constraint that certain jobs have deadlines in order to meet the real-world requirement that the orders of primary customers must not be delayed. Using the regular three-field scheduling notation [6], the