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Challenges and Achievements in Job Shop Scheduling with Blocking Constraints and Total Tardiness Minimization

Julia Lange
Otto-von-Guericke-Universität Magdeburg

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JKU Managementzentrum
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Abstract:

Describing the production of customized goods as well as vehicle movements in single-track logistics systems, the job shop problem constitutes an important issue in scheduling research. While even simple variants of the problem are proven to be NP-complete, real-world planning situations demand for the consideration of practically relevant aspects such as release dates of jobs, a lack of storage capacity in the system and customer-oriented optimization criteria. It can be observed that there exists a considerable gap between the capability of exact mixed-integer programming solution methods and the requirements of complex scheduling problems in practice. Therefore, a simulated annealing metaheuristic, founded on permutation-based encodings of a schedule and interchange-focused neighborhood structures, is implemented and the generation of high quality solutions can be reported. Nonetheless, the necessity to apply an advanced repair technique to overcome significant feasibility issues in the construction of neighboring solutions cuts down beneficial effects especially for larger instances. A matheuristic procedure is proposed in order to combine advantageous effects of mixed-integer programming and heuristic components. Thereby, important steps are made towards solving a still sparsely understood combinatorial optimization problem.