

# Exact and Heuristic Methods for the Oven Scheduling Problem

Marie-Louise Lackner<sup>a</sup>, Christoph Mrkvicka<sup>b</sup>, Nysret Musliu<sup>a</sup> Daniel Walkiewicz<sup>b</sup>, Felix Winter<sup>a</sup>

<sup>a</sup> Christian Doppler Laboratory for Artificial Intelligence and Optimization for Planning and Scheduling, DBAI, TU Wien, Austria

<sup>b</sup>MCP GmbH, Austria

The Oven Scheduling Problem is a new parallel batch scheduling problem that arises in the area of electronic component manufacturing. Jobs need to be scheduled to one of several ovens and may be processed simultaneously in one batch if they have compatible requirements. The scheduling of jobs must respect several constraints concerning eligibility and availability of ovens, release dates of jobs, setup times between batches as well as oven capacities. Running the ovens is highly energy-intensive and thus the main objective, besides finishing jobs on time, is to minimize the cumulative batch processing time across all ovens.

We propose to solve this NP-hard scheduling problem using constraint programming and integer linear programming techniques and present two different modelling approaches, one based on batch positions and another on representative jobs for batches. Additionally, we propose an approach based on simulated annealing to solve larger instances. An extensive experimental evaluation of our solution methods is performed on a diverse set of problem instances. We show that our methods can find feasible solutions for instances of realistic size, many of those being provably optimal or nearly optimal solutions.

**Acknowledgements:** The financial support by the Austrian Federal Ministry for Digital and Economic Affairs, the National Foundation for Research, Technology and Development and the Christian Doppler Research Association is gratefully acknowledged.