Research School for
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Competence-aware scheduling and operator assignment for mixed-model assembly line optimization

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Mixed-model assembly lines (MMALs) are used to produce multiple versions of a product to meet diverse customer demands based on model preferences. This range of product variations often leads to fluctuations in processing time at certain workstations. If these fluctuations exceed the designated cycle time, work overload can occur, especially when multiple models with high processing times are processed back-to-back. To mitigate this, careful model sequencing is required to minimize overload.

The primary goal of the Mixed-Model Sequencing Problem with Workload Minimization (MMSP-W) is to find an optimal sequence of models to minimize total work overload. In MMALs, manual labor is typical, and an operator's competence level significantly impacts performance. Lower competence levels can lead to longer processing times, increasing the likelihood of overload. Therefore, it is essential to consider both the sequence of models and the assignment of operators based on their competencies.

To address this, we extended the MMSP-W to include operator assignment, aligning operators with tasks to reduce gaps between required and actual competence levels. The added complexity also increases problem-solving times, which we manage by using a heuristic similar to a Benders decomposition approach. Our findings suggest that this approach manages to find alternative product sequences that are otherwise not possible while reducing the level of competence needed in the operator pool.